

B.E
Computer Science and Engineering

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING
(Common to CSE & ISE)**

III SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT31	Engineering Mathematics - III	Mathematics	04	-	03	25	100	125
2	10CS32	Electronic Circuits	CSE/ISE	04	-	03	25	100	125
3	10CS33	Logic Design	CSE/ISE	04	-	03	25	100	125
4	10CS34	Discrete Mathematical Structures	CSE/ISE	04	-	03	25	100	125
5	10CS35	Data Structures with C	CSE/ISE	04	-	03	25	100	125
6	10CS36	Object Oriented Programming with C++	CSE/ISE	04	-	03	25	100	125
7	10CSL37	Data Structures with C/C++ Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL38	Electronic Circuits & Logic Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

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IV SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT41	Engineering Mathematics - IV	Maths	04	-	03	25	100	125
2	10CS42	Graph Theory and Combinatorics	CSE/ISE	04	-	03	25	100	125
3	10CS43	Design and Analysis of Algorithms	CSE/ISE	04	-	03	25	100	125
4	10CS44	Unix and Shell Programming	CSE/ISE	04	-	03	25	100	125
5	10CS45	Microprocessors	CSE/ISE	04	-	03	25	100	125
6	10CS46	Computer Organization	CSE/ISE	04	-	03	25	100	125
7	10CSL47	Design and Analysis of Algorithms Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL48	Microprocessors Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

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B.E. COMPUTER SCIENCE AND ENGINEERING**

V SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10IS51	Software Engineering	CSE/ISE	04	-	03	25	100	125
2	10CS52	Systems Software	CSE/ISE	04	-	03	25	100	125
3	10CS53	Operating Systems	CSE/ISE	04	-	03	25	100	125
4	10CS54	Database Management Systems	CSE/ISE	04	-	03	25	100	125
5	10CS55	Computer Networks - I	CSE/ISE	04	-	03	25	100	125
6	10CS56	Formal Languages and Automata Theory	CSE/ISE	04	-	03	25	100	125
7	10CSL57	Database Applications Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL58	Systems Software & Operating Systems Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VI SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theor y	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10AL61	Management and Entrepreneurship	CSE/ISE/ MBA	04	-	03	25	100	125
2	10CS62	Unix System Programming	CSE/ISE	04	-	03	25	100	125
3	10CS63/ 10IS662	Compiler Design	CSE/ISE	04	-	03	25	100	125
4	10CS64	Computer Networks - II	CSE/ISE	04	-	03	25	100	125
5	10CS65 / 10IS665	Computer Graphics and Visualization	CSE/ISE	04	-	03	25	100	125
6	10CS66x	Elective I (Group-A)	CSE/ISE	04	-	03	25	100	125
7	10CSL67	Computer Graphics and Visualization Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL68	Unix System Programming and Compiler Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective I – Group A

10CS661/10IS661

Operations Research

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10CS71	Object-Oriented Modeling and Design	CSE/ISE	04	-	03	25	100	125
2	10CS72/ 10IS752	Embedded Computing Systems	CSE/ISE	04	-	03	25	100	125
3	10CS73	Programming the Web	CSE/ISE	04	-	03	25	100	125
4	10CS74	Advanced Computer Architectures	CSE/ISE	04	-	03	25	100	125
5	10CS75x	Elective II (Group-B)	CSE/ISE	04	-	03	25	100	125
6	10CS76x	Elective III(Group-C)	CSE/ISE	04	-	03	25	100	125
7	10CSL77	Networks Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL78	Web Programming Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective II – Group B

Elective III – Group C

10CS753/10IS753	Java and J2EE	10CS766/10IS766	Fuzzy Logic
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VIII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	Marks		
							IA	Exam	Total
1	10IS81	Software Architectures	CSE/ISE	04	-	03	25	100	125
2	10CS82	System Modeling and Simulation	CSE/ISE	04	-	03	25	100	125
3	10CS83x	Elective IV(Group-D)	CSE/ISE	04	-	03	25	100	125
4	10CS84x	Elective V(Group-E)	CSE/ISE	04	-	03	25	100	125
5	10CS85	Project Work	CSE		06	03	100	100	200
6	10CS86	Seminar	CSE	-	-	-	50	-	50
Total				16	06		250	500	750

Elective IV – Group D

10CS832/10IS832 Web 2.0 and Rich Internet Applications

Elective V– Group E

10CS842 Software Testing

ENGINEERING MATHEMATICS III
(Common to CSE & ISE)

Subject Code: 10MAT31
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **7 Hours**
Fourier Series: Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT - 2 **6 Hours**
Fourier Transforms: Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT – 3 **6 Hours**
Partial Differential Equations (P.D.E): Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT - 4 **7 Hours**
Applications of P.D.E: Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems)

PART – B

UNIT – 5 **6 Hours**
Numerical Methods: Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel iterative method. Definition of eigen values

and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT - 6

7 Hours

Numerical Methods *contd.*: Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule (All formulae / rules without proof)

UNIT - 7

6 Hours

Calculus of Variations: Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT - 8

7 Hours

Difference Equations and Z-transforms: Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition, Khanna Publishers, 2007.
(Chapters: 10, 22.1 to 22.5, 17.1 to 17.5, 18.1 to 18.2, 18.4 to 18.5, 18.7, 28.1 to 28.2, 28.4 to 28.9, 29.1, 29.5, 29.8 to 29.12, 34.1 to 34.5, 30.1 to 30.2, 23.1 to 23.5, 23.7, 23.9 to 23.11, 23.16)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata Mcgraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

ELECTRONIC CIRCUITS
(Common to CSE & ISE)

Subject Code: 10CS32

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT - 1

7 Hours

Transistors, UJTs, and Thyristors: Operating Point, Common-Emitter Configuration, Thermal Runaway, Transistor Switch, Unijunction Transistors, SCR.

UNIT - 2

6 Hours

Field Effect Transistors: Bipolar Junction Transistors versus Field Effect Transistors, Junction Field Effect Transistors, Metal Oxide Field Effect Transistors, Differences between JFETs and MOSFETs, Handling MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices, Insulated Gate Bipolar Transistors (IGBTs)

UNIT - 3

6 Hours

Optoelectronic Devices: Introduction, Photosensors, Photoconductors, Photodiodes, Phototransistors, Light-Emitting Diodes, Liquid Crystal Displays, Cathode Ray Tube Displays, Emerging Display Technologies, Optocouplers

UNIT - 4

7 Hours

Small Signal Analysis of Amplifiers: Amplifier Bandwidth: General Frequency Considerations, Hybrid h-Parameter Model for an Amplifier, Transistor Hybrid Model, Analysis of a Transistor Amplifier using complete h-Parameter Model, Analysis of a Transistor Amplifier Configurations using Simplified h-Parameter Model (CE configuration only), Small-Signal Analysis of FET Amplifiers, Cascading Amplifiers, Darlington Amplifier, Low-Frequency Response of Amplifiers (BJT amplifiers only).

PART - B

UNIT - 5

6 Hours

Large Signal Amplifiers, Feedback Amplifier: Classification and characteristics of Large Signal Amplifiers, Feedback Amplifiers: Classification of Amplifiers, Amplifier with Negative Feedback, Advantages of Negative Feedback, Feedback Topologies, Voltage-Series (Series-Shunt)

Feedback, Voltage-Shunt (Shunt-Shunt) Feedback, Current-Series (Series-Series) Feedback, Current-Shunt (Shunt-Series) Feedback.

UNIT - 6

7 Hours

Sinusoidal Oscillators, Wave-Shaping Circuits: Classification of Oscillators, Conditions for Oscillations: Barkhausen Criterion, Types of Oscillators, Crystal Oscillator, Voltage-Controlled Oscillators, Frequency Stability.

Wave-Shaping Circuits: Basic RC Low-Pass Circuit, RC Low-Pass Circuit as Integrator, Basic RC High-Pass Circuit, RC High-Pass Circuit as Differentiator, Multivibrators, Integrated Circuit (IC) Multivibrators.

UNIT - 7

7 Hours

Linear Power Supplies, Switched mode Power Supplies: Linear Power Supplies: Constituents of a Linear Power Supply, Designing Mains Transformer; Linear IC Voltage Regulators, Regulated Power Supply Parameters.

Switched Mode Power Supplies: Switched Mode Power Supplies, Switching Regulators, Connecting Power Converters in Series, Connecting Power Converters in Parallel

UNIT - 8

6 Hours

Operational Amplifiers: Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter, Sine Wave Oscillators.

Text Book:

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2009.
(4.1, 4.2, 4.7, 4.8, 5.1 to 5.3, 5.5, 5.6, 5.8, 5.9, 5.13, 5.14, 6.1, 6.3, 7.1 to 7.5, 7.10 to 7.14, Listed topics only from 8, 10.1, 11, 12.1, 12.2, 12.3, 12.5, 13.1 to 13.6, 13.9, 13.10, 14.1, 14.2, 14.6, 14.7, 15.1, 15.5 to 15.7. 16.3, 16.4, 17.12 to 17.22)

Reference Books:

1. Jacob Millman, Christos Halkias, Chetan D Parikh: Millman's Integrated Electronics – Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill, 2010.
2. R. D. Sudhaker Samuel: Electronic Circuits, Sanguine-Pearson, 2010.

LOGIC DESIGN
(Common to CSE & ISE)

Subject Code: 10CS33
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART-A

UNIT – 1 **7 Hours**

Digital Principles, Digital Logic: Definitions for Digital Signals, Digital Waveforms, Digital Logic, 7400 TTL Series, TTL Parameters The Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic, Introduction to HDL.

UNIT – 2 **6 Hours**

Combinational Logic Circuits

Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard Covers, HDL Implementation Models.

UNIT – 3 **6 Hours**

Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits

UNIT – 4 **7 Hours**

Clocks, Flip-Flops: Clock Waveforms, TTL Clock, Schmitt Trigger, Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits, HDL Implementation of FLIP-FLOP

PART-B

UNIT – 5 **6 Hours**

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register Implementation in HDL

UNIT – 6 **7 Hours**

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Presettable Counters,

Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL

UNIT – 7

7 Hours

Design of Synchronous and Asynchronous Sequential Circuits: Design of Synchronous Sequential Circuit: Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, Implementation using Read Only Memory, Algorithmic State Machine, State Reduction Technique.

Asynchronous Sequential Circuit: Analysis of Asynchronous Sequential Circuit, Problems with Asynchronous Sequential Circuits, Design of Asynchronous Sequential Circuit, FSM Implementation in HDL

UNIT – 8

6 Hours

D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution

Text Book:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Cengage Learning, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007.
5. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

DISCRETE MATHEMATICAL STRUCTURES
(Common to CSE & ISE)

Subject Code: 10CS34
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, A First Word on Probability, Countable and Uncountable Sets

UNIT – 2 **7 Hours**

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference

UNIT – 3 **6 Hours**

Fundamentals of Logic *contd.*: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – 4 **7 Hours**

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions

PART – B

UNIT – 5 **7 Hours**

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions

UNIT – 6 **7 Hours**

Relations *contd.*: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions

UNIT – 7 **6 Hours**

Groups: Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets, and Lagrange's Theorem.

Coding Theory and Rings: Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices

UNIT – 8

6 Hours

Group Codes: Decoding with Coset Leaders, Hamming Matrices

Rings and Modular Arithmetic: The Ring Structure – Definition and Examples, Ring Properties and Substructures, The Integers Modulo n

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education, 2004.
(Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.
4. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

DATA STRUCTURES WITH C (Common to CSE & ISE)

Subject Code: 10CS35

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

8 Hours

BASIC CONCEPTS: Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement

UNIT - 2

6 Hours

ARRAYS and STRUCTURES: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays

UNIT - 3**6 Hours**

STACKS AND QUEUES: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4**6 Hours**

LINKED LISTS: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists

PART - B**UNIT - 5****6 Hours**

TREES – 1: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps.

UNIT - 6**6 Hours**

TREES – 2, GRAPHS: Binary Search Trees, Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees, The Graph Abstract Data Type.

UNIT - 7**6 Hours**

PRIORITY QUEUES Single- and Double-Ended Priority Queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps.

UNIT - 8**8 Hours**

EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Splay Trees.

Text Book:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
(Chapters 1, 2.1 to 2.6, 3, 4, 5.1 to 5.3, 5.5 to 5.11, 6.1, 9.1 to 9.5, 10)

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009.
3. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.

4. Robert Kruse & Bruce Leung: Data Structures & Program Design in C, Pearson Education, 2007.

**OBJECT ORIENTED PROGRAMMING WITH C++
(Common to CSE & ISE)**

Subject Code: 10CS36
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1

6 Hours

Introduction: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types

Function Components, argument passing, inline functions, function overloading, recursive functions

UNIT 2

7 Hours

Classes & Objects – I: Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions

UNIT 3

7 Hours

Classes & Objects –II: Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications

Operator overloading using friend functions such as +, -, pre-increment, post-increment, [] etc., overloading <<, >>.

UNIT 4

6 Hours

Inheritance – I: Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes

PART – B

UNIT 5

6 Hours

Inheritance – II: Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes

UNIT 6**7 Hours**

Virtual functions, Polymorphism: Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

UNIT 7**6 Hours**

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations

UNIT 8**7 Hours**

Exception Handling, STL: Exception handling fundamentals, Exception handling options

STL: An overview, containers, vectors, lists, maps.

Text Books:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.

Reference Books:

1. Stanley B.Lippmann, Josee Lajore: C++ Primer, 4th Edition, Pearson Education, 2005.
2. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
3. K R Venugopal, Rajkumar Buyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.

DATA STRUCTURES WITH C/C++ LABORATORY
(Common to CSE & ISE)

Subject Code: 10CSL37**I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

1. Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
2. Design, develop, and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and then to print both the expressions. The expression consists of

single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).

3. Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).
4. Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations:
 - a. Insert
 - b. Delete
 - c. Display
5. Design, develop, and execute a program in C++ based on the following requirements:

An EMPLOYEE class is to contain the following data members and member functions:

Data members: Employee_Number (an integer), Employee_Name (a string of characters), Basic_Salary (an integer), All_Allowances (an integer), IT (an integer), Net_Salary (an integer).

Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.

(All_Allowances = 123% of Basic; Income Tax (IT) = 30% of the gross salary (= basic_Salary _ All_Allowance); Net_Salary = Basic_Salary + All_Allowances – IT)
6. Design, develop, and execute a program in C++ to create a class called STRING and implement the following operations. Display the results after every operation by overloading the operator <<.
 - i. STRING s1 = "VTU"
 - ii. STRING s2 = "BELGAUM"
 - iii. STIRNG s3 = s1 + s2; (Use copy constructor)
7. Design, develop, and execute a program in C++ to create a class called STACK using an array of integers and to implement the following operations by overloading the operators + and - :
 - i. s1=s1 + element; where s1 is an object of the class STACK and element is an integer to be pushed on to top of the stack.
 - ii. s1=s1- ; where s1 is an object of the class STACK and - operator pops off the top element.

Handle the STACK Empty and STACK Full conditions. Also display the contents of the stack after each operation, by overloading the operator <<.

8. Design, develop, and execute a program in C++ to create a class called LIST (linked list) with member functions to insert an element at the front of the list as well as to delete an element from the front of the list. Demonstrate all the functions after creating a list object.
9. Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.
10. Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to the heap. Use the array representation for the heap. Display the array at the end of insertion phase.
11. Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations:
 - i. Create a doubly linked list by adding each node at the front.
 - ii. Insert a new node to the left of the node whose key value is read as an input.
 - iii. Delete the node of a given data if it is found, otherwise display appropriate message.
 - iv. Display the contents of the list.(Note: Only either (a,b and d) or (a, c and d) may be asked in the examination)
12. Design, develop, and execute a program in C++ to create a class called DATE with methods to accept two valid dates in the form dd/mm/yy and to implement the following operations by overloading the operators + and -. After every operation the results are to be displayed by overloading the operator <<.
 - i. $\text{no_of_days} = d1 - d2$; where $d1$ and $d2$ are DATE objects, $d1 \geq d2$ and no_of_days is an integer.
 - ii. $d2 = d1 + \text{no_of_days}$; where $d1$ is a DATE object and no_of_days is an integer.
13. Design, develop, and execute a program in C++ to create a class called OCTAL, which has the characteristics of an octal number.

Implement the following operations by writing an appropriate constructor and an overloaded operator +.

- i. `OCTAL h = x` ; where x is an integer
- ii. `int y = h + k` ; where h is an OCTAL object and k is an integer.

Display the OCTAL result by overloading the operator <<. Also display the values of h and y.

14. Design, develop, and execute a program in C++ to create a class called BIN_TREE that represents a Binary Tree, with member functions to perform inorder, preorder and postorder traversals. Create a BIN_TREE object and demonstrate the traversals.

Note: In the examination each student picks one question from a lot of *all* the 14 questions.

ELECTRONIC CIRCUITS & LOGIC DESIGN LABORATORY (Common to CSE & ISE)

Subject Code: 10CSL38

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks : 50

PART-A

1. a) Design and construct a suitable circuit and demonstrate the working of positive clipper, double-ended clipper and positive clamper using diodes.
b) Demonstrate the working of the above circuits using a simulation package.
2. a) Design and construct a suitable circuit and determine the frequency response, input impedance, output impedance, and bandwidth of a CE amplifier.
b) Design and build the CE amplifier circuit using a simulation package and determine the voltage gain for two different values of supply voltage and for two different values of emitter resistance.
3. a) Design and construct a suitable circuit and determine the drain characteristics and transconductance characteristics of an enhancement-mode MOSFET.
b) Design and build CMOS inverter using a simulation package and verify its truth table.

4. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
5. a) Design and construct a rectangular waveform generator (Op- Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op- Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
6. Design and implement an astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

PART – B

7. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
10. a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify its working.
11. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate its working.

12. Design and construct a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.

Notes:

1. In the examination, each student picks one question from the lot of questions, either from Part-A or from Part-B. About half the students in the batch are to get a question from Part-A while the rest are to get the question from Part-B.
2. Any simulation package like MultiSim / Pspice etc may be used.

IV SEMESTER

ENGINEERING MATHEMATICS IV
(Common to CSE & ISE)

Subject Code: 10MAT41
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Numerical Methods: Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams- Bashforth predictor and corrector methods (All formulae without Proof).

UNIT – 2 **7 Hours**

Complex Variables: Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition
Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT – 3 **6 Hours**

Complex Integration: Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only)

UNIT – 4 **7 Hours**

Series solution of Ordinary Differential Equations and Special Functions:

Series solution – Frobenius method, Series solution of Bessel's

D.E. leading to Bessel function of first kind. Equations reducible to Bessel's

D.E., Series solution of Legendre's D.E. leading to Legendre Polynomials.

Rodrigue's formula

PART – B

UNIT - 5

6 Hours

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$,
 $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule,
Baye's theorem.

UNIT – 6

7 Hours

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson,
Normal and Exponential distributions.

UNIT - 7

7 Hours

Sampling, Sampling distribution, Standard error. Testing of hypothesis for
means. Confidence limits for means, Student's t distribution, Chi-square
distribution as a test of goodness of fit.

UNIT - 8

6 Hours

Concept of joint probability – Joint probability distribution, Discrete and
Independent random variables, Expectation, Covariance, Correlation
coefficient

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic
matrices. Markov chains, Higher transition probabilities. Stationary
distribution of regular Markov chains and absorbing states

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition,
Khanna Publishers, 2007
(Chapters: 31.1, 31.3 to 31.5, 31.7 to 31.8, 20.1 to 20.20.10, 20.12 to
20.14, 20.16 to 20.19, 16.1 to 16.6, 16.10, 16.13 to 16.14, 24.4 to
24.6, 25.12 to 25.14, 26.1 to 26.6, 26.7 to 26.10, 26.14 to 26.16,
27.1 to 27.6, 27.14, 27.17 to 27.18)
2. Seymour Lipschutz: Probability, Schaum's series.
(Chapters: 5 & 7)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

**GRAPH THEORY AND COMBINATORICS
(Common to CSE & ISE)****Subject Code: 10CS42****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT - 1****7 Hours****Introduction to Graph Theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits**UNIT – 2****6 Hours****Introduction to Graph Theory *contd.*:** Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials**UNIT - 3****6 Hours****Trees:** Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes**UNIT - 4****7 Hours****Optimization and Matching:** Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory**PART – B****UNIT - 5****6 Hours****Fundamental Principles of Counting:** The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers**UNIT - 6****6 Hours****The Principle of Inclusion and Exclusion:** The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials

UNIT - 7**7 Hours**

Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator

UNIT - 8**7 Hours**

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
(Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

1. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005.
2. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
3. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.
4. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

**DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE & ISE)**

Subject Code: 10CS43	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART – A**UNIT – 1****7 Hours**

INTRODUCTION: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms
Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

UNIT - 2**6 Hours**

DIVIDE AND CONQUER: Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort and its performance.

UNIT - 3 **7 Hours**

THE GREEDY METHOD: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

UNIT - 4 **6 Hours**

DYNAMIC PROGRAMMING: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

PART – B

UNIT - 5 **7 Hours**

DECREASE-AND-CONQUER APPROACHES, SPACE-TIME TRADEOFFS: Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting
Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

UNIT – 6 **7 Hours**

LIMITATIONS OF ALGORITHMIC POWER AND COPING WITH THEM: Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.

UNIT - 7 **6 Hours**

COPING WITH LIMITATIONS OF ALGORITHMIC POWER:

Backtracking: n - Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem.

Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.

Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem, Knapsack Problem

UNIT – 8 **6 Hours**

PRAM ALGORITHMS: Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems,

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
(Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
(Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai: Introduction to the Design and Analysis of Algorithms A Strategic Approach, Tata McGraw Hill, 2005.

UNIX AND SHELL PROGRAMMING
(Common to CSE & ISE)

Subject Code: 10CS44	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART – A

UNIT – 1 The Unix Operating System, The UNIX architecture and Command Usage, The File System	6 Hours
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UNIT - 2 Basic File Attributes, the vi Editor	6 Hours
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UNIT – 3 The Shell, The Process, Customizing the environment	7 Hours
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UNIT - 4 More file attributes, Simple filters	7 Hours
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PART – B

UNIT – 5 Filters using regular expressions,	6 Hours
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UNIT – 6 Essential Shell Programming	6 Hours
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UNIT - 7
awk – An Advanced Filter

7 Hours

UNIT - 8
perl - The Master Manipulator

7 Hours

Text Book:

1. Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.
(Chapters 1.2, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19)

Reference Books:

1. Behrouz A. Forouzan and Richard F. Gilberg: UNIX and Shell Programming, Cengage Learning, 2005.
2. M.G. Venkateshmurthy: UNIX & Shell Programming, Pearson Education, 2005.

MICROPROCESSORS
(Common to CSE & ISE)

Subject Code: 10CS45

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART A

UNIT – I

7 Hours

Introduction, Microprocessor Architecture – 1: A Historical Background, The Microprocessor-Based Personal Computer Systems.

The Microprocessor and its Architecture: Internal Microprocessor Architecture, Real Mode Memory Addressing.

UNIT – 2

7 Hours

Microprocessor Architecture – 2, Addressing Modes: Introduction to Protected Mode Memory Addressing, Memory Paging, Flat Mode Memory Addressing Modes: Data Addressing Modes, Program Memory Addressing Modes, Stack Memory Addressing Modes

UNIT – 3

6 Hours

Programming – 1: Data Movement Instructions: MOV Revisited, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Segment Override Prefix, Assembler Details.

Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division.

UNIT - 4

6 Hours

Programming – 2: Arithmetic and Logic Instructions (continued): BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons.

Program Control Instructions: The Jump Group, Controlling the Flow of the Program, Procedures, Introduction to Interrupts, Machine Control and Miscellaneous Instructions.

PART B

UNIT - 5

6 Hours

Programming – 3: Combining Assembly Language with C/C++: Using Assembly Language with C/C++ for 16-Bit DOS Applications and 32-Bit Applications

Modular Programming, Using the Keyboard and Video Display, Data Conversions, Example Programs

UNIT - 6

7 Hours

Hardware Specifications, Memory Interface – 1: Pin-Outs and the Pin Functions, Clock Generator, Bus Buffering and Latching, Bus Timings, Ready and Wait State, Minimum versus Maximum Mode.

Memory Interfacing: Memory Devices

UNIT – 7

6 Hours

Memory Interface – 2, I/O Interface – 1: Memory Interfacing (continued): Address Decoding, 8088 Memory Interface, 8086 Memory Interface.

Basic I/O Interface: Introduction to I/O Interface, I/O Port Address Decoding.

UNIT 8

7 Hours

I/O Interface – 2, Interrupts, and DMA: I/O Interface (continued): The Programmable Peripheral Interface 82C55, Programmable Interval Timer 8254.

Interrupts: Basic Interrupt Processing, Hardware Interrupts: INTR and INTA/; Direct Memory Access: Basic DMA Operation and Definition.

Text Book:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.
(Listed topics only from the Chapters 1 to 13)

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.

2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. James L. Antonakos: The Intel Microprocessor Family: Hardware and Software Principles and Applications, Cengage Learning, 2007.

COMPUTER ORGANIZATION
(Common to CSE & ISE)

Subject Code: 10CS46
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT - 1 **6 Hours**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing,

UNIT - 2 **7 Hours**

Machine Instructions and Programs *contd.*: Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

UNIT - 3 **6 Hours**

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses

UNIT - 4 **7 Hours**

Input/Output Organization *contd.*: Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

PART – B

UNIT - 5 **7 Hours**

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage

UNIT - 6**7 Hours**

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations

UNIT - 7**6 Hours**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control

UNIT - 8**6 Hours**

Multicores, Multiprocessors, and Clusters: Performance, The Power Wall, The Switch from Uniprocessors to Multiprocessors, Amdahl's Law, Shared Memory Multiprocessors, Clusters and other Message Passing Multiprocessors, Hardware Multithreading, SISD, IMD, SIMD, SPMD, and Vector.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
(Listed topics only from Chapters 1, 2, 4, 5, 6, 7)
2. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
(Listed topics only)

Reference Books:

1. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
2. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
(Common to CSE & ISE)

Subject Code: 10CSL47**I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

Design, develop and implement the specified algorithms for the following problems using C/C++ Language in LINUX / Windows environment.

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n .
The elements can be read from a file or can be generated using the random number generator.
2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.
3.
 - a. Obtain the Topological ordering of vertices in a given digraph.
 - b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7.
 - a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
 - b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

MICROPROCESSORS LABORATORY
(Common to CSE & ISE)

Subject Code : 10CSL48	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

Notes:

- **Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM, TASM etc may be used.**
 - **Program should have suitable comments.**
 - **The board layout and the circuit diagram of the interface are to be provided to the student during the examination.**
1. a) Search a key element in a list of „n“ 16-bit numbers using the Binary search algorithm.
b) Read the status of eight input bits from the Logic Controller Interface and display „FF“ if it is the parity of the input read is even; otherwise display 00.
 2. a) Write two ALP modules stored in two different files; one module is to read a character from the keyboard and the other one is to display a character. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line.
b) Implement a BCD Up-Down Counter on the Logic Controller Interface.

3. a) Sort a given set of „n“ numbers in ascending order using the Bubble Sort algorithm.
 b) Read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display $X*Y$.
4. a) Read an alphanumeric character and display its equivalent ASCII code at the center of the screen.
 b) Display messages FIRE and HELP alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
5. a) Reverse a given string and check whether it is a palindrome or not.
 b) Assume any suitable message of 12 characters length and display it in the rolling fashion on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages. (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
6. a) Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriate messages. Also display the length of the stored strings.
 b) Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times on a 7-segment display interface.
7. a) Read your name from the keyboard and display it at a specified location on the screen after the message “**What is your name?**” You must clear the entire screen before display.
 b) Scan a 8 x 3 keypad for key closure and to store the code of the key pressed in a memory location or display on screen. Also display row and column numbers of the key pressed.
8. a) Compute nCr using recursive procedure. Assume that „n“ and „r“ are non-negative integers.
 b) Drive a Stepper Motor interface to rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).

9. a) Read the current time from the system and display it in the standard format on the screen.
b) Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
10. a) Write a program to simulate a Decimal Up-counter to display 00-99.
b) Generate a Half Rectified Sine wave form using the DAC interface. (The output of the DAC is to be displayed on the CRO).
11. a) Read a pair of input co-ordinates in BCD and move the cursor to the specified location on the screen.
b) Generate a Fully Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. a) Write a program to create a file (input file) and to delete an existing file.
b) Drive an elevator interface in the following way:
 - i. Initially the elevator should be in the ground floor, with all requests in OFF state.
 - ii. When a request is made from a floor, the elevator should move to that floor, wait there for a couple of seconds (approximately), and then come down to ground floor and stop. If some requests occur during going up or coming down they should be ignored.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

SOFTWARE ENGINEERING

Subject Code: 10IS51**I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100**

PART – A

UNIT – 1**6 Hours****Overview:** Introduction: FAQ's about software engineering, Professional and ethical responsibility.

Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT – 2**6 Hours****Critical Systems, Software Processes:** Critical Systems: A simple safety-critical system; System dependability; Availability and reliability.

Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT – 3**7 Hours****Requirements:** Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

UNIT – 4**7 Hours****System models, Project Management:** System Models: Context models; Behavioral models; Data models; Object models; Structured methods.

Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5**7 Hours****Software Design:** Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.

Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6

6 Hours

Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development.

Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7

7 Hours

Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8

6 Hours

Management: Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.

Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007.
(Chapters:- 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill, 2007.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

SYSTEM SOFTWARE

Subject Code: 10CS52

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

UNIT – 2**6 Hours**

Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT – 3**6 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One- Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

UNIT – 4**8 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

PART – B**UNIT – 5****6 Hours**

Editors and Debugging Systems: Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of The System, User-Interface Criteria

UNIT – 6**8 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

UNIT – 7**6 Hours**

Lex and Yacc – 1: Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running

LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.

UNIT – 8

6 Hours

Lex and Yacc - 2: Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

Text Books:

1. Leland.L.Beck: System Software, 3rd Edition, Pearson Education, 1997.
(Chapters 1.1 to 1.3, 2 (except 2.5.2 and 2.5.3), 3 (except 3.5.2 and 3.5.3), 4 (except 4.4.3))
2. John.R.Levine, Tony Mason and Doug Brown: Lex and Yacc, O'Reilly, SPD, 1998.
(Chapters 1, 2 (Page 2-42), 3 (Page 51-65))

Reference Books:

1. D.M.Dhamdhare: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999.

OPERATING SYSTEMS

Subject Code: 10CS53

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

UNIT – 2**7 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

UNIT – 3**7 Hours**

Process Synchronization : Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT – 4**6 Hours**

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

PART – B**UNIT – 5****7 Hours**

Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

UNIT – 6**7 Hours**

File System, Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management

UNIT – 7**6 Hours**

Secondary Storage Structures, Protection : Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

UNIT – 8**6 Hours**

Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
(Listed topics only from Chapters 1 to 12, 17, 21)

Reference Books:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

DATABASE MANAGEMENT SYSTEMS

Subject Code: 10CS54

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.

Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2

6 Hours

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3

8 Hours

Relational Model and Relational Algebra : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update

Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4

6 Hours

SQL – 1: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5

6 Hours

SQL – 2 : Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

UNIT – 6

6 Hours

Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7

6 Hours

Database Design -2: Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms

UNIT – 8

8 Hours

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003. (Chapters 16, 17.1, 17.2, 18)

Reference Books:

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

COMPUTER NETWORKS - I

Subject Code: 10CS55

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

7 Hours

Introduction: Data Communications, Networks, The Internet, Protocols & Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing

UNIT- 2

7 Hours

Physical Layer-1: Analog & Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital-digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog-to-digital conversion (only PCM), Transmission Modes, Digital-to-analog conversion

UNIT- 3

6 Hours

Physical Layer-2 and Switching: Multiplexing, Spread Spectrum, Introduction to switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT- 4

6 Hours

Data Link Layer-1: Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum.

PART - B

UNIT- 5 **6 Hours**

Data Link Layer-2: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy channels, HDLC, PPP (Framing, Transition phases only)

UNIT- 6 **7 Hours**

Multiple Access & Ethernet: Random access, Controlled Access, Channelization, Ethernet: IEEE standards, Standard Ethernet, Changes in the standard, Fast Ethernet, Gigabit Ethernet

UNIT - 7 **6 Hours**

Wireless LANs and Cellular Networks: Introduction, IEEE 802.11, Bluetooth, Connecting devices, Cellular Telephony

UNIT - 8: **7 Hours**

Network Layer: Introduction, Logical addressing, IPv4 addresses, IPv6 addresses, Internetworking basics, IPv4, IPv6, Comparison of IPv4 and IPv6 Headers.

Text Books:

1. Behrouz A. Forouzan,: Data Communication and Networking, 4th Edition Tata McGraw-Hill, 2006.
(Chapters 1.1 to 1.4, 2.1 to 2.5, 3.1 To 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.7, 12.1 to 12.3, 13.1 to 13.5, 14.1, 14.2, 15.1, 16.1, 19.1, 19.2, 20.1 to 20.3)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

FORMAL LANGUAGES AND AUTOMATA THEORY

Subject Code: 10CS56 **I.A. Marks : 25**
Hours/Week : 04 **Exam Hours: 03**
Total Hours : 52 **Exam Marks: 100**

PART - A

UNIT – 1 **7 Hours**
Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2 **7 Hours**
Finite Automata, Regular Expressions: An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3 **6 Hours**
Regular Languages, Properties of Regular Languages: Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4 **6 Hours**
Context-Free Grammars And Languages : Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages .

PART – B

UNIT – 5 **7 Hours**
Pushdown Automata: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG"s; Deterministic Pushdown Automata

UNIT – 6 **6 Hours**
Properties of Context-Free Languages: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7 **7 Hours**
Introduction To Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines;

Extensions to the basic Turing Machines; Turing Machine and Computers.

UNIT – 8

6 Hours

Undecidability: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2007.
(Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

1. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3rd Edition, PHI Learning, 2009.
2. Raymond Greenlaw, H. James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.
3. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

DATABASE APPLICATIONS LABORATORY

Subject Code: 10CSL57

I.A. Marks : 25

Hours/Week : 03

Exam Hours: 03

Total Hours : 42

Exam Marks: 50

1. Consider the following relations:

Student (*snum*: integer, *sname*: string, *major*: string, *level*: string, *age*: integer)

Class (*name*: string, *meets at*: string, *room*: string, *d*: integer)

Enrolled (*snum*: integer, *cname*: string)

Faculty (*fid*: integer, *fname*: string, *deptid*: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

- i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
- ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
- iii. Find the names of all students who are enrolled in two classes that meet at the same time.
- iv. Find the names of faculty members who teach in every room in which some class is taught.
- v. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

2. The following relations keep track of airline flight information:

Flights (*no*: integer, *from*: string, *to*: string, *distance*: integer,

Departs: time, *arrives*: time, *price*: real)

Aircraft (*aid*: integer, *aname*: string, *cruisingrange*: integer)

Certified (*eid*: integer, *aid*: integer)

Employees (*eid*: integer, *ename*: string, *salary*: integer)

Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL.

- i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000.
- ii. For each pilot who is certified for more than three aircrafts, find the *eid* and the maximum *cruisingrange* of the aircraft for which she or he is certified.
- iii. Find the names of pilots whose *salary* is less than the price of the cheapest route from Bengaluru to Frankfurt.
- iv. For all aircraft with *cruisingrange* over 1000 Kms, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
- v. Find the names of pilots certified for some Boeing aircraft.
- vi. Find the *aids* of all aircraft that can be used on routes from Bengaluru to New Delhi.

3. Consider the following database of student enrollment in courses & books adopted for each course.

STUDENT (regno: string, name: string, major: string, bdate:date)

COURSE (course #:int, cname:string, dept:string)

ENROLL (regno:string, course#:int, sem:int, marks:int)

BOOK _ ADOPTION (course#:int, sem:int, book-ISBN:int)

TEXT (book-ISBN:int, book-title:string, publisher:string, author:string)

- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Demonstrate how you add a new text book to the database and make this book be adopted by some department.
 - iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the „CS“ department that use more than two books.
 - v. List any department that has *all* its adopted books published by a specific publisher.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
4. The following tables are maintained by a book dealer.
- AUTHOR (author-id:int, name:string, city:string, country:string)
PUBLISHER (publisher-id:int, name:string, city:string, country:string)
CATALOG (book-id:int, title:string, author-id:int, publisher-id:int, category-id:int, year:int, price:int)
CATEGORY (category-id:int, description:string)
ORDER-DETAILS (order-no:int, book-id:int, quantity:int)
- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
 - iv. Find the author of the book which has maximum sales.
 - v. Demonstrate how you increase the price of books published by a specific publisher by 10%.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
5. Consider the following database for a banking enterprise
- BRANCH(branch-name:string, branch-city:string, assets:real)
ACCOUNT(accno:int, branch-name:string, balance:real)
DEPOSITOR(customer-name:string, accno:int)
CUSTOMER(customer-name:string, customer-street:string, customer-city:string)
LOAN(loan-number:int, branch-name:string, amount:real)
BORROWER(customer-name:string, loan-number:int)

- i. Create the above tables by properly specifying the primary keys and the foreign keys
- ii. Enter at least five tuples for each relation
- iii. Find all the customers who have at least two accounts at the *Main* branch.
- iv. Find all the customers who have an account at *all* the branches located in a specific city.
- v. Demonstrate how you delete all account tuples at every branch located in a specific city.
- vi. Generate suitable reports.
- vii. Create suitable front end for querying and displaying the results.

Instructions:

1. The exercises are to be solved in an RDBMS environment like Oracle or DB2.
2. Suitable tuples have to be entered so that queries are executed correctly.
3. Front end may be created using either VB or VAJ or any other similar tool.
4. The student need not create the front end in the examination. The results of the queries may be displayed directly.
5. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
6. Questions must be asked based on lots.

**SYSTEM SOFTWARE & OPERATING SYSTEMS
LABORATORY**

Subject Code: 10CSL58	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

PART - A

LEX and YACC Programs:

Design, develop, and execute the following programs using LEX:

1. a) Program to count the number of characters, words, spaces and lines in a given input file.

- b) Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.
- 2. a) Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately.
- b) Program to recognize whether a given sentence is simple or compound.
- 3. Program to recognize and count the number of identifiers in a given input file.

Design, develop, and execute the following programs using YACC:

- 4. a) Program to recognize a valid arithmetic expression that uses operators +, -, * and /.
- b) Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits.
- 5. a) Program to evaluate an arithmetic expression involving operators +, -, * and /.
- b) Program to recognize strings „aaab“, „abbb“, „ab“ and „a“ using the grammar ($a^n b^n, n \geq 0$).
- 6. Program to recognize the grammar ($a^n b, n \geq 10$).

PART B

UNIX Programming:

Design, develop, and execute the following programs:

- 7. a) Non-recursive shell script that accepts any number of arguments and prints them in the Reverse order, (For example, if the script is named rargs, then executing rargs A B C should produce C B A on the standard output).
- b) C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell – like program). You can assume that no arguments will be passed to the commands to be executed.
- 8. a) Shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions

- are identical, outputs the common permissions, otherwise outputs each file name followed by its permissions.
- b) C program to create a file with 16 bytes of arbitrary data from the beginning and another 16 bytes of arbitrary data from an offset of 48. Display the file contents to demonstrate how the hole in file is handled.
9. a) Shell script that accepts file names specified as arguments and creates a shell script that contains this file as well as the code to recreate these files. Thus if the script generated by your script is executed, it would recreate the original files(This is same as the “bundle” script described by Brain W. Kernighan and Rob Pike in “ The Unix Programming Environment”, Prentice – Hall India).
- b) C program to do the following: Using fork() create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait()) and prints its own process-id and the id of its child process and then exits.

Operating Systems:

10. Design, develop and execute a program in C / C++ to simulate the working of Shortest Remaining Time and Round-Robin Scheduling Algorithms. Experiment with different quantum sizes for the Round-Robin algorithm. In all cases, determine the average turn-around time. The input can be read from key board or from a file.
11. Using OpenMP, Design, develop and run a multi-threaded program to generate and print Fibonacci Series. One thread has to generate the numbers up to the specified limit and another thread has to print them. Ensure proper synchronization.
12. Design, develop and run a program to implement the Banker's Algorithm. Demonstrate its working with different data values.

Instructions:

In the examination, a combination of one LEX and one YACC problem has to be asked from Part A for a total of 30 marks and one programming exercise from Part B has to be asked for a total of 20 marks.

**MANAGEMENT AND ENTREPRENEURSHIP
(Common to All Branches)**

Subject Code: 10AL61	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

UNIX SYSTEM PROGRAMMING

Subject Code: 10CS62	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards.

UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

UNIT – 2

6 Hours

UNIX Files: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

UNIT – 3

7 Hours

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program.

UNIT – 4

7 Hours

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation,

Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

PART - B

UNIT – 5

7 Hours

Process Control : Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.

UNIT – 6

7 Hours

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.1b Timers.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

UNIT – 7

6 Hours

Interprocess Communication – 1: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.

UNIT – 8

6 Hours

Interprocess Communication – 2: Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

Text Books:

1. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999.
(Chapters 1, 5, 6, 7, 8, 9, 10)
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005.
(Chapters 7, 8, 9, 13, 14, 15)

Reference Books:

1. Marc J. Rochkind: Advanced UNIX Programming, 2nd Edition, Pearson Education, 2005.
2. Maurice J Bach: The Design of the UNIX Operating System, Pearson Education, 1987.

3. Uresh Vahalia: UNIX Internals: The New Frontiers, Pearson Education, 2001.

COMPILER DESIGN

Subject Code: 10CS63
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **8 Hours**

Introduction, Lexical analysis: Language processors; The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics.

Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

UNIT – 2 **6 Hours**

Syntax Analysis – 1: Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.

UNIT – 3 **6 Hours**

Syntax Analysis – 2: Top-down Parsing; Bottom-up Parsing.

UNIT – 4 **6 Hours**

Syntax Analysis – 3: Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables) ; Using ambiguous grammars; Parser Generators.

PART – B

UNIT – 5 **7 Hours**

Syntax-Directed Translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes.

UNIT – 6 **6 Hours**

Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.

UNIT – 7**6 Hours**

Run-Time Environments : Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

UNIT – 8**7 Hours**

Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Text Books:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.
(Chapters 1, 3.1 to 3.4, 4 excluding 4.7.5 and 4.7.6, 5.1 to 5.4, 6.1, 6.2, 6.4, 6.6, 6.7 to 6.9, 7.1 to 7.5, 8.1 to 8.6.)

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
3. Kenneth C Loudon: Compiler Construction Principles & Practice, Cengage Learning, 1997.

COMPUTER NETWORKS - II**Subject Code: 10CS64****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT - 1****6 Hours**

Packet Switching Networks - 1: Network services and internal network operation, Packet network topology, Routing in Packet networks, Shortest path routing: Bellman-Ford algorithm.

UNIT – 2**6 Hours**

Packet Switching Networks – 2: Shortest path routing (continued), Traffic management at the Packet level, Traffic management at Flow level, Traffic management at flow aggregate level.

UNIT – 3**6 Hours****TCP/IP-1:** TCP/IP architecture, The Internet Protocol, IPv6, UDP.**UNIT – 4****8 Hours****TCP/IP-2:** TCP, Internet Routing Protocols, Multicast Routing, DHCP, NAT and Mobile IP.**PART – B****UNIT - 5****7 Hours****Applications, Network Management, Network Security:** Application layer overview, Domain Name System (DNS), Remote Login Protocols, E-mail, File Transfer and FTP, World Wide Web and HTTP, Network management, Overview of network security, Overview of security methods, Secret-key encryption protocols, Public-key encryption protocols, Authentication, Authentication and digital signature, Firewalls.**UNIT – 6****6 Hours****QoS, VPNs, Tunneling, Overlay Networks:** Overview of QoS, Integrated Services QoS, Differentiated services QoS, Virtual Private Networks, MPLS, Overlay networks.**UNIT - 7****7 Hours****Multimedia Networking:** Overview of data compression, Digital voice and compression, JPEG, MPEG, Limits of compression with loss, Compression methods without loss, Overview of IP Telephony, VoIP signaling protocols, Real-Time Media Transport Protocols, Stream control Transmission Protocol (SCTP)**UNIT – 8****6 Hours****Mobile AdHoc Networks and Wireless Sensor Networks:** Overview of Wireless Ad-Hoc networks, Routing in AdHOc Networks, Routing protocols for and Security of AdHoc networks, Sensor Networks and protocol structures, Communication Energy model, Clustering protocols, Routing protocols, ZigBee technology and 802.15.4.

Text Books:

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
(7 - excluding 7.6, 8)
2. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
(9, 10 excluding 10.7, 12.1 to 12.3, 16, 17.1 to 17.6, 18.1 to 18.3, 18.5, 19, 20)

Reference Books:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Wayne Tomasi: Introduction to Data Communications and Networking, Pearson Education, 2005.

COMPUTER GRAPHICS AND VISUALIZATION

Subject Code: 10CS65
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A**UNIT – 1****7 Hours**

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics
Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2**6 Hours**

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions

UNIT – 3**7 Hours**

Input and Interaction: Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4**6 Hours**

Geometric Objects and Transformations-I: Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

PART - B**UNIT – 5****5 Hours**

Geometric Objects and Transformations-II: Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion's.

UNIT – 6**7 Hours**

Viewing: Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7**6 Hours**

Lighting and Shading: Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8**8 Hours**

Implementation: Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.

2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

OPERATIONS RESEARCH

Subject Code: 10CS661
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A

UNIT – 1 **6 Hours**

Introduction, Linear Programming – 1: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation .
 Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

UNIT – 2 **7 Hours**

LP – 2, Simplex Method – 1: Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method

UNIT – 3 **6 Hours**

Simplex Method – 2: Adapting to other model forms; Post optimality analysis; Computer implementation
 Foundation of the simplex method.

UNIT – 4 **7 Hours**

Simplex Method – 2, Duality Theory: The revised simplex method, a fundamental insight.
 The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms

PART - B

UNIT – 5 **7 Hours**

Duality Theory and Sensitivity Analysis, Other Algorithms for LP : The role of duality in sensitive analysis; The essence of sensitivity analysis;

Applying sensitivity analysis. The dual simplex method; Parametric linear programming; The upper bound technique.

UNIT – 6

7 Hours

Transportation and Assignment Problems: The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.

UNIT – 7

6 Hours

Game Theory, Decision Analysis: Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions.

Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

UNIT – 8

6 Hours

Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8th Edition, Tata McGraw Hill, 2005. (Chapters: 1, 2, 3.1 to 3.4, 4.1 to 4.8, 5, 6.1 to 6.7, 7.1 to 7.3, 8, 13, 14, 15.1 to 15.4)

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007.

SIGNALS AND SYSTEMS

Subject Code: 10CS662

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction: Definitions of a signal and a system; Classification of signals; Basic operations on signals; Elementary signals.

UNIT – 2 **7 Hours**
Systems, Time-domain representations – 1: Systems viewed as interconnections of operations; Properties of systems; Convolution; Impulse response representation; Properties of impulse response representation.

UNIT – 3 **6 Hours**
Time domain representation – 2: Differential and difference equation representations; Block diagram representations.

UNIT – 4 **6 Hours**
Fourier Representation – 1: Fourier representation: Introduction; Fourier representations for four signal classes; Orthogonality of complex sinusoidal signals.

PART – B

UNIT – 5 **6 Hours**
Fourier Representation -2: DTFS representations; Continuous-time Fourier-series representations; DTFT and FT representations; Properties of Fourier representations.

UNIT – 6 **7 Hours**
Application of Fourier representations – 1: Frequency response of LTI systems; Solution of differential and difference equations using system function.

UNIT – 7 **7 Hours**
Applications of Fourier Representations – 2, Z-Transforms – 1: Fourier transform representations for periodic signals; Sampling of continuous time signals and signal reconstruction.
Introduction to Z-transform; Properties of ROC; Properties of Z-transforms; Inversion of Z-transforms

UNIT –Z– 8 **6 Hours**
Transforms – 2: Transforms analysis of LTI systems; Transfer function; Stability and causality; Unilateral Z-transforms and its application to solve difference equations

Text Books:

1. Simon Haykin and Barry Van Veen: Signals and Systems, 2nd Edition, Wiley India, 2007.
(Chapters: 1.1 to 1.8, 2.2 to 2.5, 3.1 to 3.6, 4.2 to 4.3, 4.7, 7.1 to 7.6, 7.8)

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab: Signals and Systems, 2nd Edition, PHI, 1997, Indian reprint 2009.
2. Ganesh Rao D and Satish Tunga: Signals and Systems - A Simplified Approach, Sanguine Technical Publishers, 2003-04.

DATA COMPRESSION

Subject Code: 10CS663
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT –1 7 Hours

Introduction, Lossless Compression -1: Compression techniques; Modeling and coding.

Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle.

Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression.

UNIT – 2 6 Hours

Lossless Compression – 2: Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42.

Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresolution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

UNIT – 3 6 Hours

Basics of Lossy Coding: Some mathematical concepts: Overview; Introduction; Distortion criteria; Models.

Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.

UNIT – 4 7 Hours

Vector Quantization, Differential Encoding: Vector quantization: Overview; Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm.

Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.

PART - B

UNIT – 5

7 Hours

Some Mathematical Concepts, Transform coding: Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z- transform. Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT.

UNIT – 6

6 Hours

Subband Coding, Audio Coding: Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression. Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.

UNIT – 7

6 Hours

Wavelet-Based Compression: Overview; Introduction; Wavelets; Multiresolution and the scaling function; Implementation using Filters; Image compression; Embedded zerotree coder; Set partitioning in hierarchical trees; JPEG 2000.

UNIT – 8

7 Hours

Video Compression: Overview; Introduction; Motion compensation; Video signal representation; H.261; Model-based coding; Asymmetric applications; MPEG-1 and MPEG-2; H.263; H.264, MPEG-4 and advanced video coding; Packet video.

Text Books:

1. Khalid Sayood: Introduction to Data Compression, 3rd Edition, Elsevier, 2006. (Chapters 1, 2 excluding 2.2.1 and 2.4.3, 3.1, 3.2, 3.2.1, 3.8.2, 5, 7.1 to 7.5, 7.6, 7.6.1, 7.6.2, 8.1 to 8.3, 8.6, 9.1 to 9.5, 10.1 to 10.4, 11, 12.6 to 12.9, 13, 14.1 to 14.4, 14.9 to 14.12, 15, 16, 18.1 to 18.13)

Reference Books:

1. D. Salomon: Data Compression: The Complete Reference, Springer, 1998.

PATTERN RECOGNITION

Subject Code: 10CS664

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT – 2

7 Hours

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT – 3

7 Hours

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT – 4

6 Hours

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; k_n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

PART – B

UNIT – 5

7 Hours

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT – 6

6 Hours

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

UNIT – 7

6 Hours

Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

UNIT – 8**7 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

Text Books:

1. Richard O. Duda, Peter E. Hart, and David G. Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.

Reference Books:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

STOCHASTIC MODELS AND APPLICATIONS**Subject Code: 10CS665****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****6 Hours**

Introduction – 1: Axioms of probability; Conditional probability and independence; Random variables; Expected value and variance; Moment-Generating Functions and Laplace Transforms; conditional expectation; Exponential random variables.

UNIT – 2**6 Hours**

Introduction – 2: Limit theorems; Examples: A random graph; The Quicksort and Find algorithms; A self-organizing list model; Random permutations.

UNIT – 3**7 Hours**

Probability Bounds, Approximations, and Computations: Tail probability inequalities; The second moment and conditional expectation inequality; probability bounds via the Importance sampling identity; Poisson random variables and the Poisson paradigm; Compound Poisson random variables.

UNIT – 4**7 Hours**

Markov Chains: Introduction; Chapman-Kologorov Equations; Classification of states; Limiting and stationary probabilities; some

applications; Time-Reversible Markov Chains; Markov Chain Monte Carlo methods.

PART – B

UNIT – 5

6 Hours

The Probabilistic Method: Introduction; Using probability to prove existence; Obtaining bounds from expectations; The maximum weighted independent set problem: A bound and a random algorithm; The set covering problem; Antichains; The Lovasz Local lemma; A random algorithm for finding the minimal cut in a graph.

UNIT – 6

6 Hours

Martingales: Martingales: Definitions and examples; The martingale stopping theorem; The Hoeffding-Azuma inequality; Sub-martingales.

UNIT – 7

7 Hours

Poisson Processes, Queuing Theory – 1: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times
Queuing Theory: Introduction; Preliminaries; Exponential models

UNIT – 8

7 Hours

Queuing Theory – 2: Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

Text Books:

1. Sheldon M. Ross: Probability Models for Computer Science, Elsevier, 2002.

Reference Books:

1. B. R. Bhat: Stochastic Models Analysis and Applications, New Age International, 2000.
2. Scott L. Miller, Donald G. Childers: Probability and Random Processes with Applications to Signal Processing and Communications, Elsevier, 2004.

PROGRAMMING LANGUAGES

Subject Code: 10CS666

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction; Names, Scopes, and Bindings: The art of language design; Programming language spectrum; Why study programming languages? Compilation and interpretation; Programming environments.

Names, scope, and bindings: The notion of binding time; Object lifetime and storage management; Scope rules; Implementing scope; The meaning of names within a scope; The binding of referencing environments; Macro expansion.

UNIT – 2

7 Hours

Control Flow: Expression evaluation; Structured and unstructured flow; Sequencing; Selection; Iteration; Recursion; Non-determinacy

UNIT – 3

6 Hours

Data Types: Type systems; Type checking; Records and variants; Arrays; Strings; Sets; Pointers and recursive types; Lists; Files and Input/Output; Equality testing and assignment.

UNIT – 4

6 Hours

Subroutines and Control Abstraction: Review of stack layout; Calling sequences; Parameter passing; Generic subroutines and modules; Exception handling; Coroutines; Events.

PART – B

UNIT – 5

6 Hours

Data Abstraction and Object Orientation: Object oriented programming; Encapsulation and Inheritance; Initialization and finalization; Dynamic method binding; Multiple inheritance; Object oriented programming revisited.

UNIT – 6**7 Hours**

Functional Languages, and Logic Languages: Functional Languages: Origins; Concepts; A review/overview of scheme; Evaluation order revisited; Higher-order functions; Functional programming in perspective. Logic Languages: Concepts; Prolog; Logic programming in perspective.

UNIT – 7**6 Hours**

Concurrency: Background and motivation; Concurrency programming fundamentals; Implementing synchronization; Language-level mechanisms; Message passing.

UNIT – 8**7 Hours**

Run-Time Program Management: Virtual machines; Late binding of machine code; Inspection/introspection.

Text Books:

1. Michael L. Scott: Programming Language Pragmatics, 3rd Edition, Elsevier, 2009.
(Chapters 1.1 to 1.5, 3.1 to 3.7, 6 excluding the sections on CD, 7 excluding the ML type system, 8, 9, 10 excluding the sections on CD, 11 excluding the sections on CD, 12, 15. Note: Text Boxes titled Design & Implementation are excluded)

Reference Books:

1. Ravi Sethi: Programming languages Concepts and Constructs, 2nd Edition, Pearson Education, 1996.
2. R Sebesta: Concepts of Programming Languages, 8th Edition, Pearson Education, 2008.
3. Allen Tucker, Robert Nonan: Programming Languages, Principles and Paradigms, 2nd Edition, Tata McGraw-Hill, 2007.

COMPUTER GRAPHICS AND VISUALIZATION LABORATORY**Subject Code: 10CSL67****I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50****PART - A****Design, develop, and implement the following programs in C / C++**

1. Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

2. Program to implement Liang-Barsky line clipping algorithm.
3. Program to draw a color cube and spin it using OpenGL transformation matrices.
4. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.
5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
6. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
7. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.
8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
10. Program to display a set of values $\{f_{ij}\}$ as a rectangular mesh.

PART - B

Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

Note:

1. Any question from Part A may be asked in the examination.
2. A report of about 10 – 12 pages on the package developed in Part B, duly certified by the department must be submitted during examination.

Instructions:

In the examination, one exercise from Part A is to be asked for a total of 30 marks. The package developed under Part B has to be evaluated for a total of 20 marks.

UNIX SYSTEM PROGRAMMING AND COMPILER DESIGN LABORATORY

Subject Code: 10CSL68

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

List of Experiments for USP: Design, develop, and execute the following programs

1. Write a C/C++ POSIX compliant program to check the following limits:
 - (i) No. of clock ticks
 - (ii) Max. no. of child processes
 - (iii) Max. path length
 - (iv) Max. no. of characters in a file name
 - (v) Max. no. of open files/ process
2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.
3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.
4. Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5.
 - a) Write a C/C++ program that outputs the contents of its Environment list
 - b) Write a C / C++ program to emulate the unix **ln** command
6. Write a C/C++ program to illustrate the race condition.
7. Write a C/C++ program that creates a zombie and then calls system to execute the **ps** command to verify that the process is zombie.
8. Write a C/C++ program to avoid zombie process by forking twice.
9. Write a C/C++ program to implement the **system** function.

10. Write a C/C++ program to set up a real-time clock interval timer using the **alarm** API.

List of Experiments for Compiler Design: Design, develop, and execute the following programs.

11. Write a C program to implement the syntax-directed definition of “if E then S1” and “if E then S1 else S2”. (Refer Fig. 8.23 in the text book prescribed for 06CS62 Compiler Design, Alfred V Aho, Ravi Sethi, and Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007).
12. Write a yacc program that accepts a regular expression as input and produce its parse tree as output.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VII

SEMESTER

OBJECT-ORIENTED MODELING AND DESIGN

Subject Code: 10CS71
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history

Modeling as Design Technique: Modeling; abstraction; The three models.

Class Modeling: Object and class concepts; Link and associations concepts;

Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

UNIT – 2

6 Hours

Advanced Class Modeling, State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – 3

6 Hours

Advanced State Modeling, Interaction Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.

Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

UNIT – 4

7 Hours

Process Overview, System Conception, Domain Analysis: Process Overview: Development stages; Development life cycle.

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

PART – B

UNIT – 5

7 Hours

Application Analysis, System Design: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

UNIT – 6

7 Hours

Class Design, Implementation Modeling, Legacy Systems: Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.

Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – 7

6 Hours

Design Patterns – 1: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description
Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

UNIT – 8

6 Hours

Design Patterns – 2, Idioms: Management Patterns: Command processor; View handler.

Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
(Chapters 1 to 17, 23)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 1, 3.5, 3.6, 4)

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley- Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

EMBEDDED COMPUTING SYSTEMS

Sub Code: 10CS72
Hrs/Week: 04
Total Hrs: 52

IA Marks :25
Exam Hours :03
Exam Marks :100

PART- A

UNIT – 1 **6 Hours**

Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design

Design Example: Model Train Controller.

UNIT – 2 **7 Hours**

Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

UNIT – 3 **6 Hours**

Bus-Based Computer Systems: CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis

Design Example: Alarm Clock.

UNIT – 4 **7 Hours**

Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

PART- B

UNIT – 5 **6 Hours**

Real Time Operating System (RTOS) Based Design – 1: Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization.

UNIT – 6 **6 Hours**

RTOS-Based Design - 2: Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine

UNIT – 7

7 Hours

Distributed Embedded Systems: Distributed Network Architectures, Networks for Embedded Systems: I2C Bus, CAN Bus, SHARC Link Ports, Ethernet, Myrinet, Internet, Network Based Design. Design Example: Elevator Controller.

UNIT – 8

7 Hours

Embedded Systems Development Environment: The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler /Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.

Text Books:

1. Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 2nd Edition, Elsevier, 2008.
2. Shibu K V: Introduction to Embedded Systems, Tata McGraw Hill, 2009
(Chapters 10, 13)

Reference Books:

1. James K. Peckol: Embedded Systems, A contemporary Design Tool, Wiley India, 2008
2. Tammy Neorgaard: Embedded Systems Architecture, Elsevier, 2005.

PROGRAMMING THE WEB

Subject Code: 10CS73

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

UNIT – 1

6 Hours

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.

UNIT – 2**7 Hours**

XHTML – 2, CSS: XHTML (continued): Lists, Tables, Forms, Frames
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution.

UNIT – 3**6 Hours**

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

UNIT – 4**7 Hours**

Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification.
Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

PART - B**UNIT – 5****6 Hours**

XML: Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.

UNIT – 6**7 Hours**

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.
The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.
Database access with Perl and MySQL

UNIT – 7**6 Hours**

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control

statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT – 8

7 Hours

Ruby, Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
(Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

ADVANCED COMPUTER ARCHITECTURES

Subject Code: 10CS74

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Fundamentals Of Computer Design: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

UNIT – 2

6 Hours

Pipelining: Introduction; Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

UNIT – 3

7 Hours

Instruction –Level Parallelism – 1: ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with

prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation.

UNIT – 4

7 Hours

Instruction –Level Parallelism – 2: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

PART - B

UNIT – 5

7 Hours

Multiprocessors and Thread –Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared-memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency

UNIT – 6

6 Hours

Review of Memory Hierarchy: Introduction; Cache performance; Cache Optimizations, Virtual memory

UNIT – 7

6 Hours

Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

UNIT – 8

7 Hours

Hardware and Software for VLIW and EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

Text Books:

1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 4th Edition, Elsevier, 2007.
(Chapter. 1.1 to 1.9, 2.1 to 2.10, 4.1to 4.6, 5.1 to 5.4, Appendix A, Appendix C, Appendix G)

Reference Books:

1. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability, 2nd Edition, Tata Mc Graw Hill, 2010.

2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

ADVANCED DBMS

Subject Code: 10CS751

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Overview of Storage and Indexing, Disks and Files: Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning
Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats

UNIT – 2

7 Hours

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

UNIT – 3

6 Hours

Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, comparisons

UNIT – 4

6 Hours

Overview of Query Evaluation, External Sorting : The system catalog; Introduction to operator evaluation; Algorithms for relational operations; Introduction to query optimization; Alternative plans: A motivating example; what a typical optimizer does.
When does a DBMS sort data? A simple two-way merge sort; External merge sort

PART - B

UNIT – 5

6 Hours

Evaluating Relational Operators : The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering

UNIT – 6**7 Hours**

A Typical Relational Query Optimizer: Translating SQL queries in to Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans; Nested sub-queries; other approaches to query optimization.

UNIT – 7**7 Hours**

Physical Database Design and Tuning: Introduction; Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.

UNIT – 8**6 Hours**

More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
(Chapters 8, 9, 10, 11, 12, 13.1 to 13.3, 14, 15, 20)
2. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
(Chapter 30)

Reference Books:

1. Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.

DIGITAL SIGNAL PROCESSING**Subject Code: 10CS752****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****7 Hours**

The Discrete Fourier Transform: Its Properties and Applications : Frequency Domain Sampling; The Discrete Fourier Transform: Frequency Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to other Transforms. Properties of the DFT: Periodicity, Linearity and Symmetry Properties, Multiplication of Two DFT's and Circular Convolution, Additional DFT Properties; Linear Filtering

Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.

UNIT – 2

7 Hours

Efficient Computation of the DFT: Fast Fourier Transform Algorithms: Efficient Computation of the DFT: FFT Algorithms : Direct Computation of the DFT, Divide-and-Conquer Approach to Computation of the DFT, Radix-2 FFT Algorithms, Radix-4 FFT Algorithms, Split-Radix FFT Algorithms, Implementation of FFT Algorithms.

Applications of FFT Algorithms: Efficient computation of the DFT of Two Real Sequences, Efficient computation of the DFT of a $2N$ -Point Real Sequence, Use of the FFT Algorithm in Linear filtering and Correlation.

A Linear filtering approach to Computation of the DFT: The Goertzel Algorithm, The Chirp-Z Transform Algorithm.

Quantization Effects in the Computation of the DFT: Quantization Errors in the Direct Computation of the DFT, Quantization Errors in FFT Algorithms.

UNIT – 3

6 Hours

Implementation of Discrete-Time Systems – 1: Structures for the Realization of Discrete-Time Systems

Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Lattice and Lattice-Ladder Structures for IIR Systems.

UNIT – 4

6 Hours

Implementation of Discrete-Time Systems – 2: State-Space System Analysis and Structures: State-Space Descriptions of Systems Characterized by Difference Equations, Solution of the State-Space Equations, Relationships between Input-Output and State-Space Descriptions, State-Space Analysis in the Z-Domain, Additional State-Space Structures.

Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Numbers, Errors Resulting from Rounding and Truncation.

PART – B

UNIT – 5

6 Hours

Implementation of Discrete-Time Systems – 3: Quantization of Filter Coefficients: Analysis of Sensitivity to Quantization of Filter Coefficients, Quantization of Coefficients in FIR Filters

Round-Off Effects in Digital Filters: Limit-Cycle Oscillations in Recursive Systems, Scaling to Prevent Overflow, Statistical Characterization of Quantization effects in Fixed-Point Realizations of Digital Filters.

UNIT – 6

7 Hours

Design of Digital Filters – 1: General Considerations: Causality and its Implications, Characteristics of Practical Frequency-Selective Filters.

Design of FIR Filters: Symmetric And Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of FIR Differentiators, Design of Hilbert Transformers, Comparison of Design Methods for Linear-Phase FIR filters.

UNIT – 7

6 Hours

Design of Digital Filters – 2: Design of IIR Filters from Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, The Matched-Z Transformation, Characteristics of commonly used Analog Filters, Some examples of Digital Filters Designs based on the Bilinear Transformation.

UNIT – 8

7 Hours

Design of Digital Filters – 3: Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

Design of Digital Filters based on Least-Squares method: Padé Approximations method, Least-Square design methods, FIR least-Squares Inverse (Wiener) Filters, Design of IIR Filters in the Frequency domain.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis: Digital Signal Processing, 3rd Edition, Pearson Education, 2003. (Chapters 5, 6, 7 and 8)

Reference Books:

1. Paulo S. R. Diniz, Eduardo A. B. da Silva And Sergio L. Netto: Digital Signal Processing: System Analysis and Design, Cambridge University Press, 2002.
2. Sanjit K. Mitra: Digital Signal Processing: A Computer Based Approach, Tata Mcgraw-Hill, 2001.
3. Alan V Oppenheim and Ronald W Schaffer: Digital Signal Processing, PHI, Indian Reprint, 2008.

JAVA AND J2EE

Subject Code:10CS753

Hours/Week: 4

Total Hours: 52

IA Marks: 25

Exam Marks: 100

Exam Hours: 3

PART - A

UNIT – 1

6 Hours

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs.

Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers.

Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Type casting; Strings

Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT – 2

6 Hours

Classes, Inheritance, Exceptions, Applets : Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes.

Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading.

Exception handling: Exception handling in Java.

The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT – 3

7 Hours

Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

UNIT – 4

7 Hours

Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

PART – B

UNIT – 5

6 Hours

Java 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE

The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

UNIT – 6

7 Hours

Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT – 7

6 Hours

JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

UNIT – 8

7 Hours

Enterprise Java Beans: Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Text Books:

1. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
(Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)
2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.
(Chapters 5, 6, 11, 12, 15)

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.

MULTIMEDIA COMPUTING

Subject Code: 10CS754

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases.

Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams.

Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT – 2

7 Hours

Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options.

Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language.

UNIT – 3

7 Hours

Data Compression – 1: Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT- based Mode, Lossless Mode, Hierarchical Mode

UNIT – 4**6 Hours**

Data Compression – 2: H.261 (Px64) and H.263: Image Preparation, Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG-2, MPEG-4, MPEG-7; Fractal Compression.

PART - B**UNIT – 5****6 Hours**

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM- Based Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc.

UNIT – 6**6 Hours**

Content Analysis : Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

UNIT – 7**6 Hours**

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN

UNIT – 8**7 Hours**

Multimedia Application Design : Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

Text Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008.
(Chapters 2, 3, 4, 5, 6, 7, 8, 9)
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.
(Chapters 1, 3, 7)

Reference Books:

1. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.
2. Nalin K Sharad: Multimedia Information Networking, PHI, 2002.

DATA WAREHOUSING AND DATA MINING

Subject Code: 10CS755
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Data Warehousing:

Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata

UNIT – 2

6 Hours

Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Softwares.

UNIT – 3

6 Hours

Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications

UNIT – 4

8 Hours

Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP Growth Algorithm, Evaluation of Association Patterns

PART - B

UNIT – 5

6 Hours

Classification - 1 : Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

UNIT – 6

6 Hours

Classification - 2 : Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of clarification methods, Evaluation criteria for classification methods, Multiclass Problem.

UNIT – 7**8 Hours**

Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

UNIT – 8**6 Hours**

Web Mining: Introduction, Web content mining, Text Mining, Unstructured Text, Text clustering, Mining Spatial and Temporal Databases.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2005.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Reference Books:

1. Arun K Pujari: Data Mining Techniques 2nd Edition, Universities Press, 2009.
2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.
3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing, Mc GrawHill Publisher, 1997.

NEURAL NETWORKS**Subject Code: 10CS756****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****7 Hours****Introduction**

What is a Neural Network?, Human Brain, Models of Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks.

UNIT – 2**6 Hours****Learning Processes – 1**

Introduction, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit Assignment problem, Learning with a Teacher, Learning without a Teacher, Learning tasks, Memory, Adaptation.

UNIT – 3**7 Hours**

Learning Processes – 2, Single Layer Perceptrons: Statistical nature of the learning process, Statistical learning theory, Approximately correct model of learning.

Single Layer Perceptrons: Introduction, Adaptive filtering problem, Unconstrained optimization techniques, Linear least-squares filters, Least-mean square algorithm, Learning curves, Learning rate annealing techniques, Perceptron, Perceptron convergence theorem, Relation between the Perceptron and Bayes classifier for a Gaussian environment.

UNIT – 4

6 Hours

Multilayer Perceptrons – 1: Introduction, Some preliminaries, Back-propagation Algorithm, Summary of back-propagation algorithm, XOR problem, Heuristics for making the back-propagation algorithm perform better, Output representation and decision rule, Computer experiment, Feature detection, Back-propagation and differentiation.

PART - B

UNIT – 5

7 Hours

Multilayer Perceptrons – 2: Hessian matrix, Generalization, approximation of functions, Cross validation, Network pruning techniques, virtues and limitations of back- propagation learning, Accelerated convergence of back propagation learning, Supervised learning viewed as an optimization problem, Convolution networks.

UNIT – 6

6 Hours

Radial-Basic Function Networks – 1: Introduction, Cover's theorem on the separability of patterns, Interpolation problem, Supervised learning as an ill-posed Hypersurface reconstruction problem, Regularization theory, Regularization networks, Generalized radial-basis function networks, XOR problem, Estimation of the regularization parameter.

UNIT – 7

6 Hours

Radial-Basic Function Networks – 2, Optimization – 1: Approximation properties of RBF networks, Comparison of RBF networks and multilayer Perceptrons, Kernel regression and it's relation to RBF networks, Learning strategies, Computer experiment.

Optimization using Hopfield networks: Traveling salesperson problem, Solving simultaneous linear equations, Allocating documents to multiprocessors.

UNIT – 8

7 Hours

Optimization Methods – 2:

Iterated gradient descent, Simulated Annealing, Random Search, Evolutionary computation- Evolutionary algorithms, Initialization, Termination criterion, Reproduction, Operators, Replacement, Schema theorem

Text Books:

1. Simon Haykin: Neural Networks - A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999.
(Chapters 1.1-1.8, 2.1-2.15, 3.1-3.10, 4.1-4.19, 5.1-5.14)
2. Kishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.
(Chapters 7.1-7.5)

Reference Books:

1. B.Yegnanarayana: Artificial Neural Networks, PHI, 2001.

C# PROGRAMMING AND .NET

Subject Code: 10CS761

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

The philosophy of .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime

UNIT – 2

6 Hours

Building C# Applications: The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET

IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class

UNIT – 3

8 Hours

C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces

UNIT – 4

6 Hours

Object- Oriented Programming with C#: Forms Defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

PART – B

UNIT – 5

6 Hours

Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception(System. System Exception), Custom Application-Level Exception(System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of “new”, The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

UNIT – 6

6 Hours

Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (I Comparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type)

UNIT – 7

8 Hours

Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer . Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

UNIT – 8

6 Hours

Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly

Text Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, 4th Edition, Wiley India, 2009.
Chapters: 1 to 11 (up to pp.369)
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.

(Programming Examples 3.7, 3.10, 5.5, 6.1, 7.2, 7.4, 7.5, 7.6, 8.1, 8.2, 8.3, 8.5, 8.7, 8.8, 9.1, 9.2, 9.3, 9.4, 10.2, 10.4, 11.2, 11.4, 12.1, 12.4, 12.5, 12.6, 13.1, 13.2, 13.3, 13.6, 14.1, 14.2, 14.4, 15.2, 15.3, 16.1, 16.2, 16.3, 18.3, 18.5, 18.6)

Reference Books:

1. Tom Archer: Inside C#, WP Publishers, 2001.
2. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill, 2004.

DIGITAL IMAGE PROCESSING

Subject Code: 10CS762

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Digitized Image and its properties: Basic concepts, Image digitization, Digital image properties

UNIT – 2

7 Hours

Image Preprocessing: Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3

7 Hours

Segmentation – 1: Thresholding, Edge-based segmentation.

UNIT – 4

7 Hours

Segmentation – 2: Region based segmentation, Matching.

PART – B

UNIT – 5

7 Hours

Image Enhancement: Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT – 6

6 Hours

Image Compression: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT – 7**7 Hours**

Shape representation: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 8**6 Hours**

Morphology: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

Text Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision, 2nd Edition, Thomson Learning, 2001.
(Chapters 2, 4.1 to 4.3, 5.1 to 5.4, 6, 11.1 to 11.4, 11.7)
2. Rafael C Gonzalez and Richard E Woods: Digital Image Processing, 3rd Edition, Pearson Education, 2003.
(Chapters 3.1 to 3.7, 4.1 to 4.5, 8.1 to 8.5)

Reference Books:

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI, 1997, Indian Reprint 2009.
2. B.Chanda, D Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2002.

GAME THEORY**Subject Code: 10CS763****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****8 Hours**

Introduction, Strategic Games: What is game theory? The theory of rational choice; Interacting decision makers.

Strategic games; Examples: The prisoner’s dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria.

UNIT – 2**6 Hours**

Mixed Strategy Equilibrium: Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed, Illustration: Expert Diagnosis; Equilibrium in a single population, Illustration: Reporting a crime; The formation of players' beliefs; Extensions; Representing preferences by expected payoffs.

UNIT – 3**6 Hours**

Extensive Games: Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg's model of duopoly, Buying votes.

UNIT – 4**6 Hours**

Extensive games: Extensions and Discussions: Extensions: Allowing for simultaneous moves, Illustrations: Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction.

PART – B**UNIT – 5****7 Hours**

Bayesian Games, Extensive Games with Imperfect Information: Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations.

Extensive games with imperfect information; Strategies; Nash equilibrium; Beliefs and sequential equilibrium; Signaling games; Illustration: Strategic information transmission.

UNIT – 6**7 Hours**

Strictly Competitive Games, Evolutionary Equilibrium: Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games.

Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio.

UNIT – 7**6 Hours**

Iterated Games: Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Some Nash equilibria of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.

UNIT – 8

6 Hours

Coalitional Games and Bargaining: Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, Exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining

Text Books:

1. Martin Osborne: An Introduction to Game Theory, Oxford University Press, Indian Edition, 2004.
(Listed topics only from Chapters 1 to 11, 13, 14, 16)

Reference Books:

1. Roger B. Myerson: Game Theory: Analysis of Conflict, Harvard University Press, 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green: Microeconomic Theory. Oxford University Press, New York, 1995.
3. Philip D. Straffin, Jr.: Game Theory and Strategy, The Mathematical Association of America, January 1993.

ARTIFICIAL INTELLIGENCE

Subject Code: 10CS764

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

UNIT – 2

7 Hours

Informed Search, Exploration, Constraint Satisfaction, Adversarial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search

for CSPs. Adversarial search: Games; Optimal decisions in games; Alpha-Beta pruning.

UNIT – 3

6 Hours

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT – 4

6 Hours

First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting

PART – B

UNIT – 5

6 Hours

Inference in First-Order Logic – 2: Forward chaining; Backward chaining; Resolution.

UNIT – 6

7 Hours

Knowledge Representation: Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

UNIT – 7

7 Hours

Planning, Uncertainty, Probabilistic Reasoning: Planning: The problem; Planning with state-space approach; Planning graphs; Planning with propositional logic.

Uncertainty: Acting under certainty; Inference using full joint distributions; Independence; Bayes' rule and its use.

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks.

UNIT – 8

6 Hours

Learning, AI: Present and Future: Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory.

AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.
(Chapters 1.1, 2, 3.1 to 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1, 6.2, 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6, 14.1, 14.2, 14.3, 14.4, 18, 27)

Reference Books:

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2009.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

STORAGE AREA NETWORKS

Subject Code: 10CS765

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART –A

UNIT - 1

7 Hours

Introduction to Information Storage and Management, Storage System Environment: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle

Components of Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance.

UNIT - 2

6 Hours

Data Protection, Intelligent Storage system: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares

Components of an Intelligent Storage System, Intelligent Storage Array

UNIT - 3

7 Hours

Direct-Attached Storage, SCSI, and Storage Area Networks: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies.

UNIT - 4

6 Hours

NAS, IP SAN: General – Purpose Service vs. NAS Devices, Benefits of NAS, NAS File I / O, Components of NAS, NAS Implementations, NAS

File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. iSCSI, FCIP.

PART - B

UNIT - 5

6 Hours

Content-Addressed Storage, Storage Virtualization: Fixed Content and Archives, Types of Archive, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples

Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualizations Configurations, Storage Virtualization Challenges, Types of Storage Virtualization

UNIT - 6

6 Hours

Business Continuity, Backup and Recovery: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions.

Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies.

UNIT - 7

7 Hours

Local Replication, Remote Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure.

UNIT - 8

7 Hours

Securing the Storage Infrastructure, Managing the Storage Infrastructure: Storage Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking

Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution.

Text Books:

1. G. Somasundaram, Alok Shrivastava (Editors): Information Storage and Management, EMC Education Services, Wiley India, 2009.

Reference Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
2. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003.

3. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002.

FUZZY LOGIC

Subject Code: 10CS766
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Classical Sets and Fuzzy Sets: Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity.

Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions

Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

UNIT – 2

6 Hours

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations - Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

UNIT – 3

6 Hours

Membership Functions: Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

UNIT – 4

7 Hours

Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic: Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods

Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers

Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

PART - B

UNIT – 5

6 Hours

Classical Logic and Fuzzy Logic: Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR, Logical Proofs, Deductive Inferences. Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, Other forms of the Implication Operation, Other forms of the Composition Operation

UNIT – 6

6 Hours

Fuzzy Rule- Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference

UNIT – 7

7 Hours

Fuzzy Decision Making : Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multiobjective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.

UNIT – 8

7 Hours

Fuzzy Classification: Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering

Text Books:

1. Timothy J. Ross: Fuzzy Logic with Engineering Applications, 2nd Edition, Wiley India, 2006..
(Chapter 1 (pp 1-14), Chapter 2 (pp 17-34), Chapter 3 (pp 46-70), Chapter 4 (pp 87-122), Chapter 5 (pp 130-146), Chapter 6 (pp 151-178), Chapter 7 (pp 183-210), Chapter 8 (pp 232-254), Chapter 9 (pp 313-352), Chapter 10 (pp 371 – 400))

Reference Books:

1. B Kosko: Neural Networks and Fuzzy systems: A Dynamical System approach, PHI, 1991.

Networks Laboratory

Subject Code: 10CSL77

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

Note: Student is required to solve one problem from PART-A and one problem from PART-B. The questions are allotted based on lots. Both questions carry equal marks.

PART A – Simulation Exercises

The following experiments shall be conducted using either NS228/OPNET or any other suitable simulator.

1. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network with the links connected as follows:
n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
5. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

PART-B

Implement the following in C/C++:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program for distance vector algorithm to find suitable path for transmission.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.

10. Implement the above program using as message queues or FIFOs as IPC channels.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Note:

In the examination, a combination of one problem has to be asked from Part A for a total of 25 marks and one problem from Part B has to be asked for a total of 25 marks. The choice must be based on random selection from the entire lots.

Web Programming Laboratory

Subject Code: 10CSL78

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
 - a) Input: A number n obtained using prompt
Output: The first n Fibonacci numbers
 - b) Input: A number n obtained using prompt
Output: A table of numbers from 1 to n and their squares using **alert**
2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)
3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.
4. a) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include

USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

- b) Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.
5. a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc.
b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.
6. a) Write a Perl program to accept the User Name and display a greeting message randomly chosen from a list of 4 greeting messages.
b) Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a Perl program to display a digital clock which displays the current time of the server.
8. Write a Perl program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.
9. Write a PHP program to store current date-time in a COOKIE and display the „Last visited on” date-time on the web page upon reopening of the same page.
10. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
11. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
12. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VIII SEMESTER

SOFTWARE ARCHITECTURES

Subject Code: 10IS81

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

UNIT – 2

7 Hours

Architectural Styles and Case Studies: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Studies: Keyword in Context; Instrumentation software; Mobile robotics; Cruise control; Three vignettes in mixed style.

UNIT – 3

6 Hours

Quality: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

UNIT – 4

7 Hours

Architectural Patterns – 1: Introduction; From mud to structure: Layers, Pipes and Filters, Blackboard.

PART – B

UNIT – 5 **7 Hours**

Architectural Patterns – 2: Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control.

UNIT – 6 **6 Hours**

Architectural Patterns – 3: Adaptable Systems: Microkernel; Reflection.

UNIT – 7 **6 Hours**

Some Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT – 8 **7 Hours**

Designing and Documenting Software Architecture: Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

Text Books:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
(Chapters 1, 2, 4, 5, 7, 9)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 2, 3.1 to 3.4)
3. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2007.
(Chapters 1.1, 2, 3)

Reference Books:

1. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Pearson Education, 1995.

Web Reference: <http://www.hillside.net/patterns/>

SYSTEM MODELING AND SIMULATION

Sub Code: 10CS82	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT – 1 8 Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT – 2 6 Hours

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing. Simulation in Java; Simulation in GPSS

UNIT – 3 6 Hours

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT – 4 6 Hours

Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration..

PART – B

UNIT – 5 8 Hours

Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

UNIT – 6**6 Hours**

Input Modeling : Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – 7**6 Hours**

Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – 8**6 Hours**

Verification, Calibration, and Validation; Optimization: Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.
(Listed topics only from Chapters1 to 12)

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007.

WIRELESS NETWORKS AND MOBILE COMPUTING**Sub Code: 10CS831****IA Marks : 25****Hrs/Week: 04****Exam Hours : 03****Total Hrs: 52****Exam Marks : 100****PART-A****UNIT – 1****6 Hours**

Mobile Computing Architecture: Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing.

UNIT – 2**7 Hours**

Wireless Networks – 1: GSM and SMS: Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications

UNIT – 3**6 Hours**

Wireless Networks – 2: GPRS : GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS

UNIT – 4**7 Hours**

Wireless Networks – 3: CDMA, 3G and WiMAX: Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

PART - B**UNIT – 5****6 Hours**

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6

UNIT – 6**7 Hours**

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development : The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

UNIT – 7**6 Hours**

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

UNIT – 8**7 Hours**

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet

event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

Text Books:

1. Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2d Edition, Tata McGraw Hill, 2010
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

WEB 2.0 AND RICH INTERNET APPLICATIONS

Sub Code: 10CS832

Hrs/ Week: 04

Total Hours: 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT – 1

6 Hours

Introduction, Ajax – 1: Web 2.0 and Rich Internet Applications, Overview of Ajax, Examples of usage of Ajax: Updating web page text, Chatting in real time, Dragging and dropping, Downloading images. Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST, Using Ajax together with XML.

UNIT – 2

7 Hours

Ajax – 2: Handling multiple XMLHttpRequest objects in the same page, Using two XMLHttpRequest objects, Using an array of XMLHttpRequest objects, Using inner functions, Downloading JavaScript, connecting to Google Suggest, Creating google.php, Downloading from other domains with Ajax, HTML header request and Ajax, Defeating caching, Examples. Building XML and working with XML in JavaScript, Getting the document element, Accessing any XML element, Handling whitespace in Firefox, Handling cross-browser whitespace, Accessing XML data directly, Validating XML, Further examples of Rich Internet Applications with Ajax.

UNIT – 3**6 Hours**

Ajax – 3: Drawing user’s attention to downloaded text, Styling text, colors and background using CSS, Setting element location in the web pages, Setting the stacking order of web page elements, Further examples of using Ajax. Displaying all the data in an HTML form, Working with PHP server variables, Getting the data in to array format, Wrapping applications in to a single PHP page, Validating input from the user, Validating integers and text, DOM, Appending new elements to a web page using the DOM and Ajax, Replacing elements using the DOM, Handling timeouts in Ajax, Downloading images with Ajax, Example programs.

UNIT – 4**7 Hours**

Flex – 1 : Introduction: Understanding Flex Application Technologies, Using Flex Elements, Working with Data Services (Loading Data at Runtime), The Differences between Traditional and Flex Web Applications, Understanding How Flex Applications Work, Understanding Flex and Flash Authoring. Building Applications with the Flex Framework: Using Flex Tool Sets, Creating Projects, Building Applications, Deploying Applications Framework Fundamentals: Understanding How Flex Applications Are Structured, Loading and Initializing Flex Applications, Understanding the Component Life Cycles, Loading One Flex Application into Another Flex Application, Differentiating Between Flash Player and the Flex Framework, Caching the Framework, Understanding Application Domains, Localization, Managing Layout: Flex Layout Overview, Making Fluid Interfaces, Putting It All Together.

PART B**UNIT – 5****7 Hours**

Flex – 2: MXML: Understanding MXML Syntax and Structure, Making MXML Interactive Working with UI Components: Understanding UI Components, Buttons, Value Selectors, Text Components, List-Based Controls, Pop-Up Controls, Navigators, Control Bars Customizing Application Appearance: Using Styles, Skinning components, Customizing the preloader, Themes, Runtime CSS

UNIT – 6**6 Hours**

Flex – 3: ActionScript: Using ActionScript, MXML and ActionScript Correlations, Understanding ActionScript Syntax, Variables and Properties, Inheritance, Interfaces, Handling Events, Error Handling, Using XML

UNIT – 7**7 Hours**

Flex – 4: Managing State: Creating States, Applying States, Defining States, Adding and Removing Components, Setting Properties, Setting Styles,

Setting Event Handlers, Using Action Scripts to Define States, Managing Object Creation Policies, Handling State Events, Understanding State Life Cycles, When To Use States.Using Effects and Transitions: Using Effects, Creating Custom Effects, Using Transitions, Creating Custom Transitions.

UNIT – 8

6 Hours

Flex – 5: Working with Data: Using Data Models, Data Binding, Enabling Data Binding for Custom Classes, Data Binding Examples, Building data binding proxies. Validating and Formatting Data: Validating user input, Formatting Data.

Text Books:

1. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2009.
(Listed topics from Chapters 3, 4, 6, 7, 11, 12)
2. Chafic Kazon and Joey Lott: Programming Flex 3, O'Reilly, June 2009.
(Listed topics from Chapters 1 to 8, 12 to 15)

Reference Books:

1. Jack Herrington and Emily Kim: Getting Started with Flex 3, O'Reilly, 1st Edition, 2008.
2. Michele E. Davis and John A. Phillips: Flex 3 - A Beginner's Guide, Tata McGraw-Hill, 2008.
3. Colin Moock: Essential Actionscript 3.0, O'Reilly Publications, 2007.
4. Nicholas C Zakas et al : Professional Ajax, 2nd Edition, Wrox/Wiley India, 2008.

VLSI DESIGN AND ALGORITHMS

Sub Code: 10CS833

Hrs/Week: 04

Total Hrs: 52

IA Marks 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT 1

6 Hours

Digital Systems and VLSI: Why design Integrated Circuits? Integrated Circuits manufacturing, CMOS Technology, Integrated Circuit Design Techniques, IP-based Design.

UNIT 2

8 Hours

Fabrication and Devices: Fabrication Processes, Transistors, Wires and vias, SCMOS Design Rules, Layout design and tools.

UNIT 3

6 Hours

Logic Gates – 1: Combinatorial logic functions, Static Complementary gates, Switch Logic.

UNIT 4

6 Hours

Logic Gates – 2: Alternative gate Circuits, Low Power gates, Delay through resistive interconnect; Delay through inductive interconnect, Design for yield, Gates as IP.

PART - B

UNIT 5

6 Hours

Combinational Logic Networks: Standard cell-based layout, Combinatorial network delay, Logic and interconnect design, Power Optimization, Switch logic networks, Combinational logic testing.

UNIT 6

6 Hours

Sequential Machines: Latches and Flip-flops, Sequential systems and clocking disciplines, Clock generators, Sequential systems design, Power optimization, Design validation, Sequential testing.

UNIT 7

6 Hours

Architecture Design: Register Transfer design, High Level Synthesis, Architecture for Low Power, Architecture testing.

UNIT 8

8 Hours

Design Problems and Algorithms : Placement and Partitioning: Circuit Representation, Wire-length Estimation, Types of Placement Problems, Placement Algorithms, Constructive Placement, Iterative Improvement, Partitioning, The Kernighan-Lin Partitioning Algorithm. Floor Planning: Concepts, Shape functions and floor plan sizing. Routing: Types of Local Routing Problems, Area Routing, Channel Routing, Introduction to Global Routing, Algorithms for Global Routing

Text Books:

1. Wayne Wolf: Modern VLSI Design - IP-Based Design, 4th Edition, PHI Learning, 2009.
(Listed topics only from Chapters 1 to 5, and 8)
2. Sabih H. Gerez: Algorithms for VLSI Design Automation, Wiley India, 2007.
(Listed topics only from Chapters 7, 8, and 9)

NETWORK MANAGEMENT SYSTEMS

Sub Code: 10CS834	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT 1

7 Hours

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

UNIT 2

6 Hours

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

UNIT 3

6 Hours

SNMPv1 Network Management - 1 : Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview.

UNIT 4

7 Hours

SNMPv1 Network Management – 2: The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base.The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

PART - B

UNIT 5

6 Hours

SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications; ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

UNIT 6

6 Hours

Broadband Network Management: ATM Networks: Broadband Networks and Services, ATM Technology – Virtual Path-Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation, ATM Digital Exchange Interface Management.

UNIT 7

6 Hours

Broadband Network Management: Broadband Access Networks and Technologies – Broadband Access Networks, roadband Access Technology; HFCT Technology – The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

UNIT 8

8Hours

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem

Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

Text Books:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Edition, Pearson Education, 2010.

Reference Books:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

INFORMATION AND NETWORK SECURITY

Subject Code: 10CS835

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT 1

6 Hours

Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan

UNIT 2

6 Hours

Security Technology-1: Introduction; Physical design; Firewalls; Protecting Remote Connections

UNIT 3

6 Hours

Security Technology – 2: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

UNIT 4

8 Hours

Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

PART - B

UNIT 5 **8 Hours**
Introduction to Network Security, Authentication Applications: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs Kerberos, X.509 Directory Authentication Service.

UNIT 6 **6 Hours**
Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME

UNIT 7 **6 Hours**
IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 8 **6 Hours**
Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

Text Books:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005. (Chapters 5, 6, 7, 8; Exclude the topics not mentioned in the syllabus)
2. William Stallings: Network Security Essentials: Applications and Standards, 3rd Edition, Pearson Education, 2007. (Chapters: 1, 4, 5, 6, 7, 8)

Reference Book:

1. Behrouz A. Forouzan: Cryptography and Network Security, Special Indian Edition, Tata McGraw-Hill, 2007.

MICROCONTROLLER-BASED SYSTEMS

Subject Code: 10CS836
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1 **7 Hours**
Introduction, 8051 Assembly Language Programming – 1: Microcontrollers and embedded processors; Overview of the 8051 family 8051 Assembly Language Programming (ALP) -1: Inside the 8051; Introduction to 8051 ALP; Assembling and running an 8051 program; The

PC and ROM space in 8051; Data types, directives, flag bits, PSW register, register banks, and the stack.

UNIT 2

6 Hours

ALP – 2 : Jump and loop instructions; Call instructions; Time delay for various 8051 family members; I/O programming; I/O bit manipulation programming. Immediate and register addressing modes; Accessing memory using various addressing modes.

UNIT 3

7 Hours

ALP – 3 - Programming in C: Bit addresses for I/O and RAM; Extra 128 bytes of on-chip RAM in 8052. Arithmetic instructions; Signed numbers and arithmetic operations; Logic and compare instructions; rotate instruction and serialization; BCD, ASCII, and other application programs. Programming in C: Data types and time delays; I/O programming; Logic operations; Data conversion programs; Accessing code ROM space; Data serialization.

UNIT 4

6 Hours

Pin Description, Timer Programming: Pin description of 8051; Intel Hex file; Programming the 8051 timers; Counter programming; Programming Timers 0 and 1 in C.

PART – B

UNIT 5

6 Hours

Serial Port Programming, Interrupt Programming: Basics of serial communications; 8051 connections to RS232; Serial port programming in assembly and in C 8051 interrupts; Programming timer interrupts; Programming external hardware interrupts; Programming the serial communications interrupt; Interrupt priority in 8051 / 8052; Interrupt programming in C.

UNIT 6

7 Hours

Interfacing LCD, Keyboard, ADC, DAC and Sensors : LCE interfacing; Keyboard interfacing; Parallel and serial ADC; DAC interfacing; Sensor interfacing and signal conditioning

UNIT 7

7 Hours

Interfacing to External Memory, Interfacing with 8255: Memory address decoding; Interfacing 8031 / 8051 with external ROM; 8051 data memory space; Accessing external data memory in C. Interfacing with 8255; Programming 8255 in C.

UNIT 8

6 Hours

DS12887 RTC interfacing and Programming, Applications : DS12887 RTC interfacing; DS12887 RTC programming in C; Alarm, SQW, and IRQ features of DS12886 Relays and opto-isolators; Stepper motor interfacing; DC motor interfacing and PWM

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay: The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd Edition, Pearson Education,2008.

Reference Books:

1. Raj Kamal: Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education, 2007.
2. Dr. Ramani Kalpathi, Ganesh Raja: Microcontrollers and Applications, 1st Revised Edition, Sanguine - Pearson, 2010.

ADHOC NETWORKS

Sub Code: 10CS841	IA Marks	: 25
Hrs/Week: 04	Exam Hours	: 03
Total Hrs: 52	Exam Marks	: 100

PART – A

UNIT 1 **6 Hours**

Introduction: Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT 2

7 Hours

MAC – 1: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT 3 **6 Hours**

MAC – 2: Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4

7 Hours

Routing – 1: Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

PART- B

UNIT 5

6 Hours

Routing – 2: Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT 6

7 Hours

Transport Layer: Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7

6 Hours

Security: Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

UNIT 8

7 Hours

QoS: Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2005

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Adhoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

SOFTWARE TESTING

Subject Code: 10CS842

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT 1

6 Hours

A Perspective on Testing, Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 2

7 Hours

Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

UNIT 3

7 Hours

Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing, Guidelines and observations.

UNIT 4

6 Hours

Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.

PART – B

UNIT 5

7 Hours

System Testing, Interaction Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. Context of

interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing,.

UNIT 6

7 Hours

Process Framework: Validation and verification, Degrees of freedom, Varieties of software. Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback. The quality process, Planning and monitoring, Quality goals, Dependability properties, Analysis, Testing, Improving the process, Organizational factors.

UNIT 7

6 Hours

Fault-Based Testing, Test Execution: Overview, Assumptions in fault-based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Test Execution: Overview, from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.

UNIT 8

6 Hours

Planning and Monitoring the Process, Documenting Analysis and Test: Quality and process, Test and analysis strategies and plans, Risk planning, Monitoring the process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
(Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 15)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
(Listed topics only from Chapters 2, 3, 4, 16, 17, 20, 24)

REFERENCE BOOKS:

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopaldaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.
3. Brian Marrick: The Craft of Software Testing, Pearson Education, 1995.

ARM BASED SYSTEM DESIGN

Subject Code: 10CS843

I.A. Marks: 25

Hours/Week: 4

Exam Marks: 100

Total Hours: 52

Exam Hours: 3

PART – A

UNIT 1

6 Hours

Introduction: The RISC design philosophy; The ARN design philosophy; Embedded system hardware and software.ARM processor fundamentals: Registers; Current Program Status Register; Pipeline; Exceptions, interrupts and the Vector Table; Core extensions; Architecture revisions; ARM processor families.

UNIT 2

7 Hours

ARM Instruction Set and Thumb Instruction Set: ARM instruction set: Data processing instructions; Branch instructions; Load-store instructions; Software interrupt instruction; Program Status Register functions; Loading constants; ARMv5E extensions; Conditional execution.Thumb instruction set: Thumb register usage; ARM –Thumb interworking; Other branch instructions; Data processing instructions; Single-Register Load-Store instructions; Multiple-Register Load-Store instructions; Stack instructions; Software interrupt instruction.

UNIT 3

6 Hours

Writing and Optimizing ARM Assembly Code: Writing assembly code; Profiling and cycle counting; Instruction scheduling; Register allocation; Conditional execution; Looping constructs; Bit manipulation; Efficient switches; Handling unaligned data.

UNIT 4

7 Hours

Optimized Primitives: Double-precision integer multiplication; Integer normalization and count leading zeros; Division; Square roots; Transcendental functions; Endian reversal and bit operations; Saturated and rounded arithmetic; Random number generation.

PART - B

UNIT 5

7 Hours

Exception and Interrupt Handling: Exception handling; Interrupts and interrupt handling schemes

UNIT 6**7 Hours**

Caches : The memory hierarchy and the cache memory; Cache architecture; Cache policy; Coprocessor 15 and cache; Flusing and cleaning cache memory; Cache lockdown; Caches and software performance.

UNIT 7**6 Hours**

Memory – 1: Memory Protection Units: Protected regions; Initializing the MPU, cache and write buffer; Demonstration of an MPU system. Memory Management Units: Moving from MPU to an MMU; How virtual memory works; Details of the ARM MMU.

UNIT 8**6 Hours**

Memory – 2: Page tables; The translation lookaside buffer; Domains and memory access permission; The caches and write buffer; Coprocessor 15 and MMU configuration; The fast context switch extension.

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright: ARM System Developer's Guide – Designing and Optimizing System Software, Elsevier, 2004.

Reference Books:

1. David Seal (Editor): ARM Architecture Reference Manual, 2nd Edition, Addison-Wesley, 2001.
2. Steve Furber: ARM System-on-Chip Architecture, 2nd Edition, Addison-Wesley, 2000.

SERVICES ORIENTED ARCHITECTURE**Subject Code: 10CS844****I.A. Marks: 25****Hours/Week: 4****Exam Marks: 100****Total Hours: 52****Exam Hours: 3****PART – A****UNIT 1****7 Hours**

Introduction o SOA, Evolution of SOA: Fundamental SOA; Common Characteristics of contemporary SOA; Common tangible benefits of SOA; An SOA timeline (from XML to Web services to SOA); The continuing evolution of SOA (Standards organizations and Contributing vendors); The roots of SOA (comparing SOA to Past architectures).

UNIT 2**6 Hours**

Web Services and Primitive SOA : The Web services framework; Services (as Web services); Service descriptions (with WSDL); Messaging (with SOAP).

UNIT 3**6 Hours**

Web Services and Contemporary SOA – 1: Message exchange patterns; Service activity; Coordination; Atomic Transactions; Business activities; Orchestration; Choreography

UNIT 4**7 Hours**

Web Services and Contemporary SOA – 2: Addressing; Reliable messaging; Correlation; Policies; Metadata exchange; Security; Notification and eventing

PART – B**UNIT 5****7 Hours**

Principles of Service – Orientation: Services-orientation and the enterprise; Anatomy of a service-oriented architecture; Common Principles of Service-orientation; How service orientation principles inter-relate; Service-orientation and object-orientation; Native Web service support for service-orientation principles.

UNIT 6**6 Hours**

Service Layers: Service-orientation and contemporary SOA; Service layer abstraction; Application service layer, Business service layer, Orchestration service layer; Agnostic services; Service layer configuration scenarios

UNIT 7**7 Hours**

Business Process Design: WS-BPEL language basics; WS-Coordination overview; Service-oriented business process design; WS-addressing language basics; WS-Reliable Messaging language basics

UNIT 8**6 Hours**

SOA Platforms: SOA platform basics; SOA support in J2EE; SOA support in .NET; Integration considerations

Text Books:

1. Thomas Erl: Service-Oriented Architecture – Concepts, Technology, and Design, Pearson Education, 2005.

Reference Books:

1. Eric Newcomer, Greg Lomow: Understanding SOA with Web Services, Pearson Education, 2005.

Clouds, Grids, and Clusters

Subject Code: 10CS845

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT - 1

6 Hours

Introduction: Overview of Cloud Computing, Applications, Intranets and the Cloud, When can cloud Computing be used? Benefits and limitations, Security concerns, Regulatory issues

UNIT - 2

6 Hours

Business Case for Cloud, Examples of Cloud Services: Cloud computing services, Help to the business, Deleting the data center. Examples: Google, Microsoft, IBM, Salesforce.com and its uses, Cloud at Thomson Reuters.

UNIT - 3

7 Hours

Technology, Cloud Storage, Standards: Cloud Computing Technology: Clients, Security, Network, Services.
Overview of Cloud storage, Some providers of Cloud storage. Standards: Applications, Clients, Infrastructure, Service.

UNIT - 4

7 Hours

Other issues: Overview of SaaS (Software as a Service), Driving forces, Company offerings: Google, Microsoft, IBM. Software plus Service: Overview, Mobile device integration Local Clouds, Thin Clients, Migrating to the Cloud: Virtualization, Server solutions, Thin clients, Cloud services for individuals, mid-markets, and enterprises, Migration.

PART - B

UNIT - 5

7 Hours

GRID Computing – 1: Introduction: Data Center, The Grid and the Distributed/ High Performance Computing, Cluster Computing and Grid Computing, Metacomputing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web services and Grid Computing, Business Computing and the Grid – a Potential Win win Situation, e-Governance and the Grid. Technologies and Architectures for Grid Computing: Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids. OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF (Web

Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

The Grid and the Database: Issues in Database Integration with the Grid, The Requirements of a Grid enabled database, Storage Request Broker (SRB), How to integrate the Database with the Grid? The Architecture of OGSA- DAI for Offering Grid Database Services

UNIT - 6

6 Hours

GRID Computing – 2: World Wide Grid Computing Activites, Organizations and Projects: Standards Organizations, Organizations Developing Grid Computing Tool Kits, Framework and Middleware, Grid Projects and Organizations Building and Using Grid Based Solutions. Web Services and the Service Oriented Architecture (SOA): History and Background, Service Oriented Architecture, How a Web Service Works, SOAP and WSDL, Description, Creating Web Services, Server Side. Globus Toolkit: History of Globus Toolkit, Versions of Globus Toolkit, Applications of GT4 – cases, GT4 – Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data, Choreography and Coordination, Main Features of GT4 Functionality – a Summary, GT4 Architecture, GT4 Command Line Programs, GT4 Containers.

UNIT - 7

7 Hours

Cluster Computing – 1: Introduction: What is Cluster Computing, Approaches to Parallel Computing, How to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster, What is the Functionality a Cluster can offer? Categories of Clusters Cluster Middleware: Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools. Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures, High Throughput Computing Clusters, Condor. Setting up and Administering a Cluster: How to set up a Simple Cluster? Design considerations for the Front End of a Cluster, Setting up nodes, Clusters of Clusters or Metaclusters, System Monitoring, Directory Services inside the Clusters & DCE, Global Clocks Sync, Administering heterogeneous Clusters.

UNIT - 8

6 Hours

Cluster Computing – 2: Cluster Technology for High Availability: Highly Available Clusters, High Availability Parallel Computing, Mission Critical (or Business Critical or Business Continuity) Applications, Types of Failures and Errors, Cluster Architectures and Configurations for High Availability, Faults and Error Detection, Failure Recovery, Failover / Recovery Clusters. Performance Model and Simulation: Performance Measures and Metrics, Profit Effectiveness of Parallel Computing through Clusters. Process Scheduling, Load Sharing and Load Balancing: Job Management System

(JMS) Resource Management System (RMS), Queues, Hosts, Resources, Jobs and Policies, Policies for Resource Utilization, Scheduling Policies Load Sharing and Load Balancing, Strategies for Load Balancing, Modeling Parameters Case Studies of Cluster Systems: Beowulf, PARAM.

Text Books:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Hill, 2010.
2. Prabhu: Grid and Cluster Computing, PHI, 2008.

Reference Books:

1. Joshy Joseph, Craig Fellenstein: Grid Computing, Pearson Education, 2007.
2. Internet Resources

MULTI-CORE ARCHITECTURE AND PROGRAMMING

Subject Code: 10CS846

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT 1

7 Hours

Introduction

The power and potential of parallelism, Examining sequential and parallel programs, Parallelism using multiple instruction streams, The Goals: Scalability and performance portability, Balancing machine specifics with portability, A look at six parallel computers: Chip multiprocessors, Symmetric multiprocessor architectures, Heterogeneous chip designs, Clusters, Supercomputers, Observations from the six parallel computers.

UNIT 2

6 Hours

Reasoning about Performance

Motivation and basic concepts, Sources of performance loss, Parallel structure, Performance trade-offs, Measuring performance, Scalable performance.

UNIT 3

6 Hours

Examples of Multi-Core Architectures

Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller; Intel Core i7: Architecture, The Intel Core i7 Processor, Intel QuickPath Interconnect, The SCH; Intel Atom Architecture.

Introduction to Texas Instruments' Multi-Core Multilayer SoC architecture for communications, infrastructure equipment

UNIT 4 **7 Hours**

Parallel Algorithm Design

Introduction, The Task / Channel model, Foster's design methodology, Examples: Boundary value problem, Finding the maximum, The n-Body problem, Adding data input.

PART – B

UNIT 5 **7 Hours**

Parallel Programming – 1 (Using OpenMP)

Designing for threads: Task decomposition, Data decomposition, Data flow decomposition, Implications of different decompositions; Challenges in decomposition, Parallel programming patterns, A motivating problem: Error diffusion.

Threading and Parallel Programming Constructs: Synchronization, Critical sections, Deadlocks, Synchronization primitives: Semaphores, Locks, Condition variables; Messages, Flow Control-Based concepts: Fence, Barrier; Implementation-Dependent threading issues.

UNIT 6 **6 Hours**

Parallel Programming – 2 (Using OpenMP)

Introduction, The shared-memory model, Parallel *for* loops, Declaring private variables, Critical sections, Reductions, Performance improvements, More general data parallelism, Functional parallelism.

UNIT 7 **7 Hours**

Solutions to Common Parallel Programming Problems

Too many threads, Data races, deadlocks, and live locks, Heavily contended locks, Non-blocking algorithms, Thread-safe functions and libraries, Memory issues, Cache-related issues, Avoiding pipeline stalls, Data organization for high performance.

UNIT 8 **6 Hours**

Threading in the Processor

Single-Core Processors: Processor architecture fundamentals, Comparing Superscalar and EPIC architectures.

Multi-Core Processors: Hardware-based threading, Hyper-threading technology, Multi-Core processors, Multiple processor interactions, Power consumption, Beyond multi-core architecture.

NOTE: In order to acquire a sound understanding of the subject, it is desirable for the students to work in the laboratory using OpenMP. The

hands-on experience would reinforce the concepts learnt in theory. Problems similar to the ones solved in the Algorithms Laboratory can be solved and issues like speed-up achieved can be analyzed in depth. Several free tools are available from companies like INTEL to facilitate such a study.

Text Books:

1. Calvin Lin, Lawrence Snyder: Principles of Parallel Programming, Pearson Education, 2009.
(Listed topics only from Chapters 1, 2, 3)
2. Michael J. Quinn: Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2004.
(Listed topics only from Chapters 3, 17)
3. Shameem Akhter, Jason Roberts: Multi-Core Programming, Increasing Performance through Software Multithreading, Intel Press, 2006.
(Listed topics only from Chapters 3, 4, 7, 9, 10)
4. Web resources for Example Architectures of INTEL and Texas Instruments:
<http://download.intel.com/design/intarch/papers/321087.pdf> ;
<http://focus.ti.com/lit/wp/spry133/spry133.pdf>

Reference Books:

1. Introduction to Parallel Computing – Ananth Grama et. al., Pearson Education, 2009.
2. Reinders : Intel Threading Building Blocks, O'reilly –2005
3. David Culler et. al.: Parallel Computer Architecture: A Hardware/Software Approach, Elsevier, 2006.
4. Richard Gerber, Aart J.C. Bik, Kevin B. Smith, Xinmin Tian: Software Optimization Cookbook, High-Performance Recipes for IA-32 Platforms, 2nd Edition, Intel Press, 2006.

B.E
Computer Science and Engineering

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING
(Common to CSE & ISE)**

III SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT31	Engineering Mathematics - III	Mathematics	04	-	03	25	100	125
2	10CS32	Electronic Circuits	CSE/ISE	04	-	03	25	100	125
3	10CS33	Logic Design	CSE/ISE	04	-	03	25	100	125
4	10CS34	Discrete Mathematical Structures	CSE/ISE	04	-	03	25	100	125
5	10CS35	Data Structures with C	CSE/ISE	04	-	03	25	100	125
6	10CS36	Object Oriented Programming with C++	CSE/ISE	04	-	03	25	100	125
7	10CSL37	Data Structures with C/C++ Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL38	Electronic Circuits & Logic Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING
(Common to CSE & ISE)**

IV SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT41	Engineering Mathematics - IV	Maths	04	-	03	25	100	125
2	10CS42	Graph Theory and Combinatorics	CSE/ISE	04	-	03	25	100	125
3	10CS43	Design and Analysis of Algorithms	CSE/ISE	04	-	03	25	100	125
4	10CS44	Unix and Shell Programming	CSE/ISE	04	-	03	25	100	125
5	10CS45	Microprocessors	CSE/ISE	04	-	03	25	100	125
6	10CS46	Computer Organization	CSE/ISE	04	-	03	25	100	125
7	10CSL47	Design and Analysis of Algorithms Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL48	Microprocessors Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

V SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10IS51	Software Engineering	CSE/ISE	04	-	03	25	100	125
2	10CS52	Systems Software	CSE/ISE	04	-	03	25	100	125
3	10CS53	Operating Systems	CSE/ISE	04	-	03	25	100	125
4	10CS54	Database Management Systems	CSE/ISE	04	-	03	25	100	125
5	10CS55	Computer Networks - I	CSE/ISE	04	-	03	25	100	125
6	10CS56	Formal Languages and Automata Theory	CSE/ISE	04	-	03	25	100	125
7	10CSL57	Database Applications Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL58	Systems Software & Operating Systems Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VI SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theor y	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10AL61	Management and Entrepreneurship	CSE/ISE/ MBA	04	-	03	25	100	125
2	10CS62	Unix System Programming	CSE/ISE	04	-	03	25	100	125
3	10CS63/ 10IS662	Compiler Design	CSE/ISE	04	-	03	25	100	125
4	10CS64	Computer Networks - II	CSE/ISE	04	-	03	25	100	125
5	10CS65 / 10IS665	Computer Graphics and Visualization	CSE/ISE	04	-	03	25	100	125
6	10CS66x	Elective I (Group-A)	CSE/ISE	04	-	03	25	100	125
7	10CSL67	Computer Graphics and Visualization Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL68	Unix System Programming and Compiler Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective I – Group A

10CS661/10IS661

Operations Research

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10CS71	Object-Oriented Modeling and Design	CSE/ISE	04	-	03	25	100	125
2	10CS72/ 10IS752	Embedded Computing Systems	CSE/ISE	04	-	03	25	100	125
3	10CS73	Programming the Web	CSE/ISE	04	-	03	25	100	125
4	10CS74	Advanced Computer Architectures	CSE/ISE	04	-	03	25	100	125
5	10CS75x	Elective II (Group-B)	CSE/ISE	04	-	03	25	100	125
6	10CS76x	Elective III(Group-C)	CSE/ISE	04	-	03	25	100	125
7	10CSL77	Networks Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL78	Web Programming Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective II – Group B

Elective III – Group C

10CS753/10IS753	Java and J2EE	10CS766/10IS766	Fuzzy Logic
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**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VIII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	Marks		
							IA	Exam	Total
1	10IS81	Software Architectures	CSE/ISE	04	-	03	25	100	125
2	10CS82	System Modeling and Simulation	CSE/ISE	04	-	03	25	100	125
3	10CS83x	Elective IV(Group-D)	CSE/ISE	04	-	03	25	100	125
4	10CS84x	Elective V(Group-E)	CSE/ISE	04	-	03	25	100	125
5	10CS85	Project Work	CSE		06	03	100	100	200
6	10CS86	Seminar	CSE	-	-	-	50	-	50
Total				16	06		250	500	750

Elective IV – Group D

10CS832/10IS832 Web 2.0 and Rich Internet Applications

Elective V– Group E

10CS842 Software Testing

ENGINEERING MATHEMATICS III
(Common to CSE & ISE)

Subject Code: 10MAT31
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **7 Hours**
Fourier Series: Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT - 2 **6 Hours**
Fourier Transforms: Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT – 3 **6 Hours**
Partial Differential Equations (P.D.E): Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT - 4 **7 Hours**
Applications of P.D.E: Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems)

PART – B

UNIT – 5 **6 Hours**
Numerical Methods: Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel iterative method. Definition of eigen values

and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT - 6

7 Hours

Numerical Methods *contd.*: Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule (All formulae / rules without proof)

UNIT - 7

6 Hours

Calculus of Variations: Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT - 8

7 Hours

Difference Equations and Z-transforms: Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition, Khanna Publishers, 2007.
(Chapters: 10, 22.1 to 22.5, 17.1 to 17.5, 18.1 to 18.2, 18.4 to 18.5, 18.7, 28.1 to 28.2, 28.4 to 28.9, 29.1, 29.5, 29.8 to 29.12, 34.1 to 34.5, 30.1 to 30.2, 23.1 to 23.5, 23.7, 23.9 to 23.11, 23.16)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata Mcgraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

ELECTRONIC CIRCUITS
(Common to CSE & ISE)

Subject Code: 10CS32

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT - 1

7 Hours

Transistors, UJTs, and Thyristors: Operating Point, Common-Emitter Configuration, Thermal Runaway, Transistor Switch, Unijunction Transistors, SCR.

UNIT - 2

6 Hours

Field Effect Transistors: Bipolar Junction Transistors versus Field Effect Transistors, Junction Field Effect Transistors, Metal Oxide Field Effect Transistors, Differences between JFETs and MOSFETs, Handling MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices, Insulated Gate Bipolar Transistors (IGBTs)

UNIT - 3

6 Hours

Optoelectronic Devices: Introduction, Photosensors, Photoconductors, Photodiodes, Phototransistors, Light-Emitting Diodes, Liquid Crystal Displays, Cathode Ray Tube Displays, Emerging Display Technologies, Optocouplers

UNIT - 4

7 Hours

Small Signal Analysis of Amplifiers: Amplifier Bandwidth: General Frequency Considerations, Hybrid h-Parameter Model for an Amplifier, Transistor Hybrid Model, Analysis of a Transistor Amplifier using complete h-Parameter Model, Analysis of a Transistor Amplifier Configurations using Simplified h-Parameter Model (CE configuration only), Small-Signal Analysis of FET Amplifiers, Cascading Amplifiers, Darlington Amplifier, Low-Frequency Response of Amplifiers (BJT amplifiers only).

PART - B

UNIT - 5

6 Hours

Large Signal Amplifiers, Feedback Amplifier: Classification and characteristics of Large Signal Amplifiers, Feedback Amplifiers: Classification of Amplifiers, Amplifier with Negative Feedback, Advantages of Negative Feedback, Feedback Topologies, Voltage-Series (Series-Shunt)

Feedback, Voltage-Shunt (Shunt-Shunt) Feedback, Current-Series (Series-Series) Feedback, Current-Shunt (Shunt-Series) Feedback.

UNIT - 6

7 Hours

Sinusoidal Oscillators, Wave-Shaping Circuits: Classification of Oscillators, Conditions for Oscillations: Barkhausen Criterion, Types of Oscillators, Crystal Oscillator, Voltage-Controlled Oscillators, Frequency Stability.

Wave-Shaping Circuits: Basic RC Low-Pass Circuit, RC Low-Pass Circuit as Integrator, Basic RC High-Pass Circuit, RC High-Pass Circuit as Differentiator, Multivibrators, Integrated Circuit (IC) Multivibrators.

UNIT - 7

7 Hours

Linear Power Supplies, Switched mode Power Supplies: Linear Power Supplies: Constituents of a Linear Power Supply, Designing Mains Transformer; Linear IC Voltage Regulators, Regulated Power Supply Parameters.

Switched Mode Power Supplies: Switched Mode Power Supplies, Switching Regulators, Connecting Power Converters in Series, Connecting Power Converters in Parallel

UNIT - 8

6 Hours

Operational Amplifiers: Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter, Sine Wave Oscillators.

Text Book:

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2009.
(4.1, 4.2, 4.7, 4.8, 5.1 to 5.3, 5.5, 5.6, 5.8, 5.9, 5.13, 5.14, 6.1, 6.3, 7.1 to 7.5, 7.10 to 7.14, Listed topics only from 8, 10.1, 11, 12.1, 12.2, 12.3, 12.5, 13.1 to 13.6, 13.9, 13.10, 14.1, 14.2, 14.6, 14.7, 15.1, 15.5 to 15.7. 16.3, 16.4, 17.12 to 17.22)

Reference Books:

1. Jacob Millman, Christos Halkias, Chetan D Parikh: Millman's Integrated Electronics – Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill, 2010.
2. R. D. Sudhaker Samuel: Electronic Circuits, Sanguine-Pearson, 2010.

LOGIC DESIGN
(Common to CSE & ISE)

Subject Code: 10CS33
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART-A

UNIT – 1 **7 Hours**

Digital Principles, Digital Logic: Definitions for Digital Signals, Digital Waveforms, Digital Logic, 7400 TTL Series, TTL Parameters The Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic, Introduction to HDL.

UNIT – 2 **6 Hours**

Combinational Logic Circuits

Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard Covers, HDL Implementation Models.

UNIT – 3 **6 Hours**

Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits

UNIT – 4 **7 Hours**

Clocks, Flip-Flops: Clock Waveforms, TTL Clock, Schmitt Trigger, Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits, HDL Implementation of FLIP-FLOP

PART-B

UNIT – 5 **6 Hours**

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register Implementation in HDL

UNIT – 6 **7 Hours**

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Presettable Counters,

Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL

UNIT – 7

7 Hours

Design of Synchronous and Asynchronous Sequential Circuits: Design of Synchronous Sequential Circuit: Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, Implementation using Read Only Memory, Algorithmic State Machine, State Reduction Technique.

Asynchronous Sequential Circuit: Analysis of Asynchronous Sequential Circuit, Problems with Asynchronous Sequential Circuits, Design of Asynchronous Sequential Circuit, FSM Implementation in HDL

UNIT – 8

6 Hours

D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution

Text Book:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Cengage Learning, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007.
5. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

DISCRETE MATHEMATICAL STRUCTURES
(Common to CSE & ISE)

Subject Code: 10CS34
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, A First Word on Probability, Countable and Uncountable Sets

UNIT – 2 **7 Hours**

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference

UNIT – 3 **6 Hours**

Fundamentals of Logic *contd.*: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – 4 **7 Hours**

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions

PART – B

UNIT – 5 **7 Hours**

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions

UNIT – 6 **7 Hours**

Relations *contd.*: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions

UNIT – 7 **6 Hours**

Groups: Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets, and Lagrange's Theorem.

Coding Theory and Rings: Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices

UNIT – 8

6 Hours

Group Codes: Decoding with Coset Leaders, Hamming Matrices

Rings and Modular Arithmetic: The Ring Structure – Definition and Examples, Ring Properties and Substructures, The Integers Modulo n

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education, 2004.
(Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.
4. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

DATA STRUCTURES WITH C (Common to CSE & ISE)

Subject Code: 10CS35

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

8 Hours

BASIC CONCEPTS: Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement

UNIT - 2

6 Hours

ARRAYS and STRUCTURES: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays

UNIT - 3**6 Hours**

STACKS AND QUEUES: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4**6 Hours**

LINKED LISTS: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists

PART - B**UNIT - 5****6 Hours**

TREES – 1: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps.

UNIT - 6**6 Hours**

TREES – 2, GRAPHS: Binary Search Trees, Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees, The Graph Abstract Data Type.

UNIT - 7**6 Hours**

PRIORITY QUEUES Single- and Double-Ended Priority Queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps.

UNIT - 8**8 Hours**

EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Splay Trees.

Text Book:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
(Chapters 1, 2.1 to 2.6, 3, 4, 5.1 to 5.3, 5.5 to 5.11, 6.1, 9.1 to 9.5, 10)

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009.
3. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.

4. Robert Kruse & Bruce Leung: Data Structures & Program Design in C, Pearson Education, 2007.

**OBJECT ORIENTED PROGRAMMING WITH C++
(Common to CSE & ISE)**

Subject Code: 10CS36
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1

6 Hours

Introduction: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types

Function Components, argument passing, inline functions, function overloading, recursive functions

UNIT 2

7 Hours

Classes & Objects – I: Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions

UNIT 3

7 Hours

Classes & Objects –II: Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications

Operator overloading using friend functions such as +, -, pre-increment, post-increment, [] etc., overloading <<, >>.

UNIT 4

6 Hours

Inheritance – I: Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes

PART – B

UNIT 5

6 Hours

Inheritance – II: Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes

UNIT 6**7 Hours**

Virtual functions, Polymorphism: Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

UNIT 7**6 Hours**

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations

UNIT 8**7 Hours**

Exception Handling, STL: Exception handling fundamentals, Exception handling options

STL: An overview, containers, vectors, lists, maps.

Text Books:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.

Reference Books:

1. Stanley B.Lippmann, Josee Lajore: C++ Primer, 4th Edition, Pearson Education, 2005.
2. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
3. K R Venugopal, Rajkumar Buyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.

DATA STRUCTURES WITH C/C++ LABORATORY
(Common to CSE & ISE)

Subject Code: 10CSL37**I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

1. Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
2. Design, develop, and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and then to print both the expressions. The expression consists of

single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).

3. Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).
4. Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations:
 - a. Insert
 - b. Delete
 - c. Display
5. Design, develop, and execute a program in C++ based on the following requirements:

An EMPLOYEE class is to contain the following data members and member functions:

Data members: Employee_Number (an integer), Employee_Name (a string of characters), Basic_Salary (an integer), All_Allowances (an integer), IT (an integer), Net_Salary (an integer).

Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.

(All_Allowances = 123% of Basic; Income Tax (IT) = 30% of the gross salary (= basic_Salary _ All_Allowance); Net_Salary = Basic_Salary + All_Allowances – IT)
6. Design, develop, and execute a program in C++ to create a class called STRING and implement the following operations. Display the results after every operation by overloading the operator <<.
 - i. STRING s1 = "VTU"
 - ii. STRING s2 = "BELGAUM"
 - iii. STIRNG s3 = s1 + s2; (Use copy constructor)
7. Design, develop, and execute a program in C++ to create a class called STACK using an array of integers and to implement the following operations by overloading the operators + and - :
 - i. s1=s1 + element; where s1 is an object of the class STACK and element is an integer to be pushed on to top of the stack.
 - ii. s1=s1- ; where s1 is an object of the class STACK and - operator pops off the top element.

Handle the STACK Empty and STACK Full conditions. Also display the contents of the stack after each operation, by overloading the operator <<.

8. Design, develop, and execute a program in C++ to create a class called LIST (linked list) with member functions to insert an element at the front of the list as well as to delete an element from the front of the list. Demonstrate all the functions after creating a list object.
9. Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.
10. Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to the heap. Use the array representation for the heap. Display the array at the end of insertion phase.
11. Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations:
 - i. Create a doubly linked list by adding each node at the front.
 - ii. Insert a new node to the left of the node whose key value is read as an input.
 - iii. Delete the node of a given data if it is found, otherwise display appropriate message.
 - iv. Display the contents of the list.(Note: Only either (a,b and d) or (a, c and d) may be asked in the examination)
12. Design, develop, and execute a program in C++ to create a class called DATE with methods to accept two valid dates in the form dd/mm/yy and to implement the following operations by overloading the operators + and -. After every operation the results are to be displayed by overloading the operator <<.
 - i. $\text{no_of_days} = d1 - d2$; where $d1$ and $d2$ are DATE objects, $d1 \geq d2$ and no_of_days is an integer.
 - ii. $d2 = d1 + \text{no_of_days}$; where $d1$ is a DATE object and no_of_days is an integer.
13. Design, develop, and execute a program in C++ to create a class called OCTAL, which has the characteristics of an octal number.

Implement the following operations by writing an appropriate constructor and an overloaded operator +.

- i. `OCTAL h = x` ; where x is an integer
- ii. `int y = h + k` ; where h is an OCTAL object and k is an integer.

Display the OCTAL result by overloading the operator <<. Also display the values of h and y.

14. Design, develop, and execute a program in C++ to create a class called BIN_TREE that represents a Binary Tree, with member functions to perform inorder, preorder and postorder traversals. Create a BIN_TREE object and demonstrate the traversals.

Note: In the examination each student picks one question from a lot of *all* the 14 questions.

ELECTRONIC CIRCUITS & LOGIC DESIGN LABORATORY (Common to CSE & ISE)

Subject Code: 10CSL38

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks : 50

PART-A

1. a) Design and construct a suitable circuit and demonstrate the working of positive clipper, double-ended clipper and positive clamper using diodes.
b) Demonstrate the working of the above circuits using a simulation package.
2. a) Design and construct a suitable circuit and determine the frequency response, input impedance, output impedance, and bandwidth of a CE amplifier.
b) Design and build the CE amplifier circuit using a simulation package and determine the voltage gain for two different values of supply voltage and for two different values of emitter resistance.
3. a) Design and construct a suitable circuit and determine the drain characteristics and transconductance characteristics of an enhancement-mode MOSFET.
b) Design and build CMOS inverter using a simulation package and verify its truth table.

4. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
5. a) Design and construct a rectangular waveform generator (Op- Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op- Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
6. Design and implement an astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

PART – B

7. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
10. a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify its working.
11. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate its working.

12. Design and construct a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.

Notes:

1. In the examination, each student picks one question from the lot of questions, either from Part-A or from Part-B. About half the students in the batch are to get a question from Part-A while the rest are to get the question from Part-B.
2. Any simulation package like MultiSim / Pspice etc may be used.

IV SEMESTER

ENGINEERING MATHEMATICS IV
(Common to CSE & ISE)

Subject Code: 10MAT41
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Numerical Methods: Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams- Bashforth predictor and corrector methods (All formulae without Proof).

UNIT – 2 **7 Hours**

Complex Variables: Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition
Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT – 3 **6 Hours**

Complex Integration: Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only)

UNIT – 4 **7 Hours**

Series solution of Ordinary Differential Equations and Special Functions:

Series solution – Frobenius method, Series solution of Bessel's

D.E. leading to Bessel function of first kind. Equations reducible to Bessel's

D.E., Series solution of Legendre's D.E. leading to Legendre Polynomials.

Rodrigue's formula

PART – B

UNIT - 5

6 Hours

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$,
 $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule,
Baye's theorem.

UNIT – 6

7 Hours

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson,
Normal and Exponential distributions.

UNIT - 7

7 Hours

Sampling, Sampling distribution, Standard error. Testing of hypothesis for
means. Confidence limits for means, Student's t distribution, Chi-square
distribution as a test of goodness of fit.

UNIT - 8

6 Hours

Concept of joint probability – Joint probability distribution, Discrete and
Independent random variables, Expectation, Covariance, Correlation
coefficient

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic
matrices. Markov chains, Higher transition probabilities. Stationary
distribution of regular Markov chains and absorbing states

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition,
Khanna Publishers, 2007
(Chapters: 31.1, 31.3 to 31.5, 31.7 to 31.8, 20.1 to 20.20.10, 20.12 to
20.14, 20.16 to 20.19, 16.1 to 16.6, 16.10, 16.13 to 16.14, 24.4 to
24.6, 25.12 to 25.14, 26.1 to 26.6, 26.7 to 26.10, 26.14 to 26.16,
27.1 to 27.6, 27.14, 27.17 to 27.18)
2. Seymour Lipschutz: Probability, Schaum's series.
(Chapters: 5 & 7)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

GRAPH THEORY AND COMBINATORICS (Common to CSE & ISE)

Subject Code: 10CS42

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT - 1

7 Hours

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits

UNIT – 2

6 Hours

Introduction to Graph Theory *contd.*: Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials

UNIT - 3

6 Hours

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes

UNIT - 4

7 Hours

Optimization and Matching: Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory

PART – B

UNIT - 5

6 Hours

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers

UNIT - 6

6 Hours

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials

UNIT - 7**7 Hours**

Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator

UNIT - 8**7 Hours**

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
(Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

1. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005.
2. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
3. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.
4. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE & ISE)

Subject Code: 10CS43	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART – A**UNIT – 1****7 Hours**

INTRODUCTION: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms
Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

UNIT - 2**6 Hours**

DIVIDE AND CONQUER: Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort and its performance.

UNIT - 3 **7 Hours**

THE GREEDY METHOD: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

UNIT - 4 **6 Hours**

DYNAMIC PROGRAMMING: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

PART – B

UNIT - 5 **7 Hours**

DECREASE-AND-CONQUER APPROACHES, SPACE-TIME TRADEOFFS: Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting
Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

UNIT – 6 **7 Hours**

LIMITATIONS OF ALGORITHMIC POWER AND COPING WITH THEM: Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.

UNIT - 7 **6 Hours**

COPING WITH LIMITATIONS OF ALGORITHMIC POWER:

Backtracking: n - Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem.

Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.

Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem, Knapsack Problem

UNIT – 8 **6 Hours**

PRAM ALGORITHMS: Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems,

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
(Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
(Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai: Introduction to the Design and Analysis of Algorithms A Strategic Approach, Tata McGraw Hill, 2005.

UNIX AND SHELL PROGRAMMING
(Common to CSE & ISE)

Subject Code: 10CS44	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART – A

UNIT – 1 The Unix Operating System, The UNIX architecture and Command Usage, The File System	6 Hours
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UNIT - 2 Basic File Attributes, the vi Editor	6 Hours
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UNIT – 3 The Shell, The Process, Customizing the environment	7 Hours
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UNIT - 4 More file attributes, Simple filters	7 Hours
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PART – B

UNIT – 5 Filters using regular expressions,	6 Hours
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UNIT – 6 Essential Shell Programming	6 Hours
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UNIT - 7 **7 Hours**
awk – An Advanced Filter

UNIT - 8 **7 Hours**
perl - The Master Manipulator

Text Book:

1. Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.
(Chapters 1.2, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19)

Reference Books:

1. Behrouz A. Forouzan and Richard F. Gilberg: UNIX and Shell Programming, Cengage Learning, 2005.
2. M.G. Venkateshmurthy: UNIX & Shell Programming, Pearson Education, 2005.

MICROPROCESSORS
(Common to CSE & ISE)

Subject Code: 10CS45
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART A

UNIT – I **7 Hours**
Introduction, Microprocessor Architecture – 1: A Historical Background, The Microprocessor-Based Personal Computer Systems.
The Microprocessor and its Architecture: Internal Microprocessor Architecture, Real Mode Memory Addressing.

UNIT – 2 **7 Hours**
Microprocessor Architecture – 2, Addressing Modes: Introduction to Protected Mode Memory Addressing, Memory Paging, Flat Mode Memory Addressing Modes: Data Addressing Modes, Program Memory Addressing Modes, Stack Memory Addressing Modes

UNIT – 3 **6 Hours**
Programming – 1: Data Movement Instructions: MOV Revisited, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Segment Override Prefix, Assembler Details.
Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division.

UNIT - 4

6 Hours

Programming – 2: Arithmetic and Logic Instructions (continued): BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons.

Program Control Instructions: The Jump Group, Controlling the Flow of the Program, Procedures, Introduction to Interrupts, Machine Control and Miscellaneous Instructions.

PART B

UNIT - 5

6 Hours

Programming – 3: Combining Assembly Language with C/C++: Using Assembly Language with C/C++ for 16-Bit DOS Applications and 32-Bit Applications

Modular Programming, Using the Keyboard and Video Display, Data Conversions, Example Programs

UNIT - 6

7 Hours

Hardware Specifications, Memory Interface – 1: Pin-Outs and the Pin Functions, Clock Generator, Bus Buffering and Latching, Bus Timings, Ready and Wait State, Minimum versus Maximum Mode.

Memory Interfacing: Memory Devices

UNIT – 7

6 Hours

Memory Interface – 2, I/O Interface – 1: Memory Interfacing (continued): Address Decoding, 8088 Memory Interface, 8086 Memory Interface.

Basic I/O Interface: Introduction to I/O Interface, I/O Port Address Decoding.

UNIT 8

7 Hours

I/O Interface – 2, Interrupts, and DMA: I/O Interface (continued): The Programmable Peripheral Interface 82C55, Programmable Interval Timer 8254.

Interrupts: Basic Interrupt Processing, Hardware Interrupts: INTR and INTA/; Direct Memory Access: Basic DMA Operation and Definition.

Text Book:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.
(Listed topics only from the Chapters 1 to 13)

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.

2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. James L. Antonakos: The Intel Microprocessor Family: Hardware and Software Principles and Applications, Cengage Learning, 2007.

COMPUTER ORGANIZATION
(Common to CSE & ISE)

Subject Code: 10CS46
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT - 1 **6 Hours**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing,

UNIT - 2 **7 Hours**

Machine Instructions and Programs *contd.*: Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

UNIT - 3 **6 Hours**

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses

UNIT - 4 **7 Hours**

Input/Output Organization *contd.*: Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

PART – B

UNIT - 5 **7 Hours**

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage

UNIT - 6**7 Hours**

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations

UNIT - 7**6 Hours**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control

UNIT - 8**6 Hours**

Multicores, Multiprocessors, and Clusters: Performance, The Power Wall, The Switch from Uniprocessors to Multiprocessors, Amdahl's Law, Shared Memory Multiprocessors, Clusters and other Message Passing Multiprocessors, Hardware Multithreading, SISD, IMD, SIMD, SPMD, and Vector.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
(Listed topics only from Chapters 1, 2, 4, 5, 6, 7)
2. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
(Listed topics only)

Reference Books:

1. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
2. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
(Common to CSE & ISE)**Subject Code: 10CSL47****I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

Design, develop and implement the specified algorithms for the following problems using C/C++ Language in LINUX / Windows environment.

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n .
The elements can be read from a file or can be generated using the random number generator.
2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.
3.
 - a. Obtain the Topological ordering of vertices in a given digraph.
 - b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7.
 - a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
 - b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

**MICROPROCESSORS LABORATORY
(Common to CSE & ISE)**

Subject Code : 10CSL48	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

Notes:

- **Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM, TASM etc may be used.**
 - **Program should have suitable comments.**
 - **The board layout and the circuit diagram of the interface are to be provided to the student during the examination.**
1. a) Search a key element in a list of „n“ 16-bit numbers using the Binary search algorithm.
b) Read the status of eight input bits from the Logic Controller Interface and display „FF“ if it is the parity of the input read is even; otherwise display 00.
 2. a) Write two ALP modules stored in two different files; one module is to read a character from the keyboard and the other one is to display a character. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line.
b) Implement a BCD Up-Down Counter on the Logic Controller Interface.

3. a) Sort a given set of „n“ numbers in ascending order using the Bubble Sort algorithm.
 b) Read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display $X*Y$.
4. a) Read an alphanumeric character and display its equivalent ASCII code at the center of the screen.
 b) Display messages FIRE and HELP alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
5. a) Reverse a given string and check whether it is a palindrome or not.
 b) Assume any suitable message of 12 characters length and display it in the rolling fashion on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages. (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
6. a) Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriate messages. Also display the length of the stored strings.
 b) Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times on a 7-segment display interface.
7. a) Read your name from the keyboard and display it at a specified location on the screen after the message “**What is your name?**” You must clear the entire screen before display.
 b) Scan a 8 x 3 keypad for key closure and to store the code of the key pressed in a memory location or display on screen. Also display row and column numbers of the key pressed.
8. a) Compute nCr using recursive procedure. Assume that „n“ and „r“ are non-negative integers.
 b) Drive a Stepper Motor interface to rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).

9. a) Read the current time from the system and display it in the standard format on the screen.
b) Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
10. a) Write a program to simulate a Decimal Up-counter to display 00-99.
b) Generate a Half Rectified Sine wave form using the DAC interface. (The output of the DAC is to be displayed on the CRO).
11. a) Read a pair of input co-ordinates in BCD and move the cursor to the specified location on the screen.
b) Generate a Fully Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. a) Write a program to create a file (input file) and to delete an existing file.
b) Drive an elevator interface in the following way:
 - i. Initially the elevator should be in the ground floor, with all requests in OFF state.
 - ii. When a request is made from a floor, the elevator should move to that floor, wait there for a couple of seconds (approximately), and then come down to ground floor and stop. If some requests occur during going up or coming down they should be ignored.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

SOFTWARE ENGINEERING

Subject Code: 10IS51**I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100**

PART – A

UNIT – 1**6 Hours****Overview:** Introduction: FAQ's about software engineering, Professional and ethical responsibility.

Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT – 2**6 Hours****Critical Systems, Software Processes:** Critical Systems: A simple safety-critical system; System dependability; Availability and reliability.

Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT – 3**7 Hours****Requirements:** Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

UNIT – 4**7 Hours****System models, Project Management:** System Models: Context models; Behavioral models; Data models; Object models; Structured methods.

Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5**7 Hours****Software Design:** Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.

Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6

6 Hours

Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development.

Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7

7 Hours

Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8

6 Hours

Management: Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.

Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007.
(Chapters:- 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill, 2007.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

SYSTEM SOFTWARE

Subject Code: 10CS52

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

UNIT – 2**6 Hours**

Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT – 3**6 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One- Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

UNIT – 4**8 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

PART – B**UNIT – 5****6 Hours**

Editors and Debugging Systems: Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of The System, User-Interface Criteria

UNIT – 6**8 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

UNIT – 7**6 Hours**

Lex and Yacc – 1: Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running

LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.

UNIT – 8

6 Hours

Lex and Yacc - 2: Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

Text Books:

1. Leland.L.Beck: System Software, 3rd Edition, Pearson Education, 1997.
(Chapters 1.1 to 1.3, 2 (except 2.5.2 and 2.5.3), 3 (except 3.5.2 and 3.5.3), 4 (except 4.4.3))
2. John.R.Levine, Tony Mason and Doug Brown: Lex and Yacc, O'Reilly, SPD, 1998.
(Chapters 1, 2 (Page 2-42), 3 (Page 51-65))

Reference Books:

1. D.M.Dhamdhare: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999.

OPERATING SYSTEMS

Subject Code: 10CS53

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

UNIT – 2**7 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

UNIT – 3**7 Hours**

Process Synchronization : Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT – 4**6 Hours**

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

PART – B**UNIT – 5****7 Hours**

Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

UNIT – 6**7 Hours**

File System, Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management

UNIT – 7**6 Hours**

Secondary Storage Structures, Protection : Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

UNIT – 8**6 Hours**

Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
(Listed topics only from Chapters 1 to 12, 17, 21)

Reference Books:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

DATABASE MANAGEMENT SYSTEMS

Subject Code: 10CS54

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.

Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2

6 Hours

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3

8 Hours

Relational Model and Relational Algebra : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update

Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4

6 Hours

SQL – 1: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5

6 Hours

SQL – 2 : Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

UNIT – 6

6 Hours

Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7

6 Hours

Database Design -2: Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms

UNIT – 8

8 Hours

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003. (Chapters 16, 17.1, 17.2, 18)

Reference Books:

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

COMPUTER NETWORKS - I

Subject Code: 10CS55

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

7 Hours

Introduction: Data Communications, Networks, The Internet, Protocols & Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing

UNIT- 2

7 Hours

Physical Layer-1: Analog & Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital-digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog-to-digital conversion (only PCM), Transmission Modes, Digital-to-analog conversion

UNIT- 3

6 Hours

Physical Layer-2 and Switching: Multiplexing, Spread Spectrum, Introduction to switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT- 4

6 Hours

Data Link Layer-1: Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum.

PART - B

UNIT- 5 **6 Hours**

Data Link Layer-2: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy channels, HDLC, PPP (Framing, Transition phases only)

UNIT- 6 **7 Hours**

Multiple Access & Ethernet: Random access, Controlled Access, Channelization, Ethernet: IEEE standards, Standard Ethernet, Changes in the standard, Fast Ethernet, Gigabit Ethernet

UNIT - 7 **6 Hours**

Wireless LANs and Cellular Networks: Introduction, IEEE 802.11, Bluetooth, Connecting devices, Cellular Telephony

UNIT - 8: **7 Hours**

Network Layer: Introduction, Logical addressing, IPv4 addresses, IPv6 addresses, Internetworking basics, IPv4, IPv6, Comparison of IPv4 and IPv6 Headers.

Text Books:

1. Behrouz A. Forouzan,: Data Communication and Networking, 4th Edition Tata McGraw-Hill, 2006.
(Chapters 1.1 to 1.4, 2.1 to 2.5, 3.1 To 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.7, 12.1 to 12.3, 13.1 to 13.5, 14.1, 14.2, 15.1, 16.1, 19.1, 19.2, 20.1 to 20.3)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

FORMAL LANGUAGES AND AUTOMATA THEORY

Subject Code: 10CS56 **I.A. Marks : 25**
Hours/Week : 04 **Exam Hours: 03**
Total Hours : 52 **Exam Marks: 100**

PART - A

UNIT – 1 **7 Hours**
Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2 **7 Hours**
Finite Automata, Regular Expressions: An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3 **6 Hours**
Regular Languages, Properties of Regular Languages: Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4 **6 Hours**
Context-Free Grammars And Languages : Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages .

PART – B

UNIT – 5 **7 Hours**
Pushdown Automata: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG"s; Deterministic Pushdown Automata

UNIT – 6 **6 Hours**
Properties of Context-Free Languages: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7 **7 Hours**
Introduction To Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines;

Extensions to the basic Turing Machines; Turing Machine and Computers.

UNIT – 8

6 Hours

Undecidability: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2007.
(Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

1. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3rd Edition, PHI Learning, 2009.
2. Raymond Greenlaw, H. James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.
3. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

DATABASE APPLICATIONS LABORATORY

Subject Code: 10CSL57

I.A. Marks : 25

Hours/Week : 03

Exam Hours: 03

Total Hours : 42

Exam Marks: 50

1. Consider the following relations:

Student (*snum*: integer, *sname*: string, *major*: string, *level*: string, *age*: integer)

Class (*name*: string, *meets at*: string, *room*: string, *d*: integer)

Enrolled (*snum*: integer, *cname*: string)

Faculty (*fid*: integer, *fname*: string, *deptid*: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

- i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
- ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
- iii. Find the names of all students who are enrolled in two classes that meet at the same time.
- iv. Find the names of faculty members who teach in every room in which some class is taught.
- v. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

2. The following relations keep track of airline flight information:

Flights (*no*: integer, *from*: string, *to*: string, *distance*: integer,

Departs: time, *arrives*: time, *price*: real)

Aircraft (*aid*: integer, *aname*: string, *cruisingrange*: integer)

Certified (*eid*: integer, *aid*: integer)

Employees (*eid*: integer, *ename*: string, *salary*: integer)

Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL.

- i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000.
- ii. For each pilot who is certified for more than three aircrafts, find the *eid* and the maximum *cruisingrange* of the aircraft for which she or he is certified.
- iii. Find the names of pilots whose *salary* is less than the price of the cheapest route from Bengaluru to Frankfurt.
- iv. For all aircraft with *cruisingrange* over 1000 Kms, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
- v. Find the names of pilots certified for some Boeing aircraft.
- vi. Find the *aids* of all aircraft that can be used on routes from Bengaluru to New Delhi.

3. Consider the following database of student enrollment in courses & books adopted for each course.

STUDENT (regno: string, name: string, major: string, bdate:date)

COURSE (course #:int, cname:string, dept:string)

ENROLL (regno:string, course#:int, sem:int, marks:int)

BOOK _ ADOPTION (course#:int, sem:int, book-ISBN:int)

TEXT (book-ISBN:int, book-title:string, publisher:string, author:string)

- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Demonstrate how you add a new text book to the database and make this book be adopted by some department.
 - iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the „CS“ department that use more than two books.
 - v. List any department that has *all* its adopted books published by a specific publisher.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
4. The following tables are maintained by a book dealer.
- AUTHOR (author-id:int, name:string, city:string, country:string)
PUBLISHER (publisher-id:int, name:string, city:string, country:string)
CATALOG (book-id:int, title:string, author-id:int, publisher-id:int, category-id:int, year:int, price:int)
CATEGORY (category-id:int, description:string)
ORDER-DETAILS (order-no:int, book-id:int, quantity:int)
- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
 - iv. Find the author of the book which has maximum sales.
 - v. Demonstrate how you increase the price of books published by a specific publisher by 10%.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
5. Consider the following database for a banking enterprise
- BRANCH(branch-name:string, branch-city:string, assets:real)
ACCOUNT(accno:int, branch-name:string, balance:real)
DEPOSITOR(customer-name:string, accno:int)
CUSTOMER(customer-name:string, customer-street:string, customer-city:string)
LOAN(loan-number:int, branch-name:string, amount:real)
BORROWER(customer-name:string, loan-number:int)

- i. Create the above tables by properly specifying the primary keys and the foreign keys
- ii. Enter at least five tuples for each relation
- iii. Find all the customers who have at least two accounts at the *Main* branch.
- iv. Find all the customers who have an account at *all* the branches located in a specific city.
- v. Demonstrate how you delete all account tuples at every branch located in a specific city.
- vi. Generate suitable reports.
- vii. Create suitable front end for querying and displaying the results.

Instructions:

1. The exercises are to be solved in an RDBMS environment like Oracle or DB2.
2. Suitable tuples have to be entered so that queries are executed correctly.
3. Front end may be created using either VB or VAJ or any other similar tool.
4. The student need not create the front end in the examination. The results of the queries may be displayed directly.
5. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
6. Questions must be asked based on lots.

**SYSTEM SOFTWARE & OPERATING SYSTEMS
LABORATORY**

Subject Code: 10CSL58	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

PART - A

LEX and YACC Programs:

Design, develop, and execute the following programs using LEX:

1. a) Program to count the number of characters, words, spaces and lines in a given input file.

- b) Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.
- 2. a) Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately.
- b) Program to recognize whether a given sentence is simple or compound.
- 3. Program to recognize and count the number of identifiers in a given input file.

Design, develop, and execute the following programs using YACC:

- 4. a) Program to recognize a valid arithmetic expression that uses operators +, -, * and /.
- b) Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits.
- 5. a) Program to evaluate an arithmetic expression involving operators +, -, * and /.
- b) Program to recognize strings „aaab“, „abbb“, „ab“ and „a“ using the grammar ($a^n b^n, n \geq 0$).
- 6. Program to recognize the grammar ($a^n b, n \geq 10$).

PART B

UNIX Programming:

Design, develop, and execute the following programs:

- 7. a) Non-recursive shell script that accepts any number of arguments and prints them in the Reverse order, (For example, if the script is named rargs, then executing rargs A B C should produce C B A on the standard output).
- b) C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell – like program). You can assume that no arguments will be passed to the commands to be executed.
- 8. a) Shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions

- are identical, outputs the common permissions, otherwise outputs each file name followed by its permissions.
- b) C program to create a file with 16 bytes of arbitrary data from the beginning and another 16 bytes of arbitrary data from an offset of 48. Display the file contents to demonstrate how the hole in file is handled.
9. a) Shell script that accepts file names specified as arguments and creates a shell script that contains this file as well as the code to recreate these files. Thus if the script generated by your script is executed, it would recreate the original files(This is same as the “bundle” script described by Brain W. Kernighan and Rob Pike in “ The Unix Programming Environment”, Prentice – Hall India).
- b) C program to do the following: Using fork() create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait()) and prints its own process-id and the id of its child process and then exits.

Operating Systems:

10. Design, develop and execute a program in C / C++ to simulate the working of Shortest Remaining Time and Round-Robin Scheduling Algorithms. Experiment with different quantum sizes for the Round-Robin algorithm. In all cases, determine the average turn-around time. The input can be read from key board or from a file.
11. Using OpenMP, Design, develop and run a multi-threaded program to generate and print Fibonacci Series. One thread has to generate the numbers up to the specified limit and another thread has to print them. Ensure proper synchronization.
12. Design, develop and run a program to implement the Banker's Algorithm. Demonstrate its working with different data values.

Instructions:

In the examination, a combination of one LEX and one YACC problem has to be asked from Part A for a total of 30 marks and one programming exercise from Part B has to be asked for a total of 20 marks.

MANAGEMENT AND ENTREPRENEURSHIP
(Common to All Branches)

Subject Code: 10AL61	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

UNIX SYSTEM PROGRAMMING

Subject Code: 10CS62	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards.

UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

UNIT – 2

6 Hours

UNIX Files: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

UNIT – 3

7 Hours

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program.

UNIT – 4

7 Hours

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation,

Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

PART - B

UNIT – 5

7 Hours

Process Control : Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.

UNIT – 6

7 Hours

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.1b Timers.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

UNIT – 7

6 Hours

Interprocess Communication – 1: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.

UNIT – 8

6 Hours

Interprocess Communication – 2: Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

Text Books:

1. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999.
(Chapters 1, 5, 6, 7, 8, 9, 10)
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005.
(Chapters 7, 8, 9, 13, 14, 15)

Reference Books:

1. Marc J. Rochkind: Advanced UNIX Programming, 2nd Edition, Pearson Education, 2005.
2. Maurice J Bach: The Design of the UNIX Operating System, Pearson Education, 1987.

3. Uresh Vahalia: UNIX Internals: The New Frontiers, Pearson Education, 2001.

COMPILER DESIGN

Subject Code: 10CS63
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **8 Hours**

Introduction, Lexical analysis: Language processors; The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics.

Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

UNIT – 2 **6 Hours**

Syntax Analysis – 1: Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.

UNIT – 3 **6 Hours**

Syntax Analysis – 2: Top-down Parsing; Bottom-up Parsing.

UNIT – 4 **6 Hours**

Syntax Analysis – 3: Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables) ; Using ambiguous grammars; Parser Generators.

PART – B

UNIT – 5 **7 Hours**

Syntax-Directed Translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes.

UNIT – 6 **6 Hours**

Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.

UNIT – 7**6 Hours**

Run-Time Environments : Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

UNIT – 8**7 Hours**

Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Text Books:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.
(Chapters 1, 3.1 to 3.4, 4 excluding 4.7.5 and 4.7.6, 5.1 to 5.4, 6.1, 6.2, 6.4, 6.6, 6.7 to 6.9, 7.1 to 7.5, 8.1 to 8.6.)

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
3. Kenneth C Loudon: Compiler Construction Principles & Practice, Cengage Learning, 1997.

COMPUTER NETWORKS - II**Subject Code: 10CS64****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT - 1****6 Hours**

Packet Switching Networks - 1: Network services and internal network operation, Packet network topology, Routing in Packet networks, Shortest path routing: Bellman-Ford algorithm.

UNIT – 2**6 Hours**

Packet Switching Networks – 2: Shortest path routing (continued), Traffic management at the Packet level, Traffic management at Flow level, Traffic management at flow aggregate level.

UNIT – 3**6 Hours****TCP/IP-1:** TCP/IP architecture, The Internet Protocol, IPv6, UDP.**UNIT – 4****8 Hours****TCP/IP-2:** TCP, Internet Routing Protocols, Multicast Routing, DHCP, NAT and Mobile IP.**PART – B****UNIT - 5****7 Hours****Applications, Network Management, Network Security:** Application layer overview, Domain Name System (DNS), Remote Login Protocols, E-mail, File Transfer and FTP, World Wide Web and HTTP, Network management, Overview of network security, Overview of security methods, Secret-key encryption protocols, Public-key encryption protocols, Authentication, Authentication and digital signature, Firewalls.**UNIT – 6****6 Hours****QoS, VPNs, Tunneling, Overlay Networks:** Overview of QoS, Integrated Services QoS, Differentiated services QoS, Virtual Private Networks, MPLS, Overlay networks.**UNIT - 7****7 Hours****Multimedia Networking:** Overview of data compression, Digital voice and compression, JPEG, MPEG, Limits of compression with loss, Compression methods without loss, Overview of IP Telephony, VoIP signaling protocols, Real-Time Media Transport Protocols, Stream control Transmission Protocol (SCTP)**UNIT – 8****6 Hours****Mobile AdHoc Networks and Wireless Sensor Networks:** Overview of Wireless Ad-Hoc networks, Routing in AdHOc Networks, Routing protocols for and Security of AdHoc networks, Sensor Networks and protocol structures, Communication Energy model, Clustering protocols, Routing protocols, ZigBee technology and 802.15.4.

Text Books:

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
(7 - excluding 7.6, 8)
2. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
(9, 10 excluding 10.7, 12.1 to 12.3, 16, 17.1 to 17.6, 18.1 to 18.3, 18.5, 19, 20)

Reference Books:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Wayne Tomasi: Introduction to Data Communications and Networking, Pearson Education, 2005.

COMPUTER GRAPHICS AND VISUALIZATION

Subject Code: 10CS65
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A**UNIT – 1****7 Hours**

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics
Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2**6 Hours**

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions

UNIT – 3**7 Hours**

Input and Interaction: Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4**6 Hours**

Geometric Objects and Transformations-I: Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

PART - B**UNIT – 5****5 Hours**

Geometric Objects and Transformations-II: Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion's.

UNIT – 6**7 Hours**

Viewing: Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7**6 Hours**

Lighting and Shading: Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8**8 Hours**

Implementation: Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.

2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

OPERATIONS RESEARCH

Subject Code: 10CS661
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A

UNIT – 1 **6 Hours**

Introduction, Linear Programming – 1: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation .
 Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

UNIT – 2 **7 Hours**

LP – 2, Simplex Method – 1: Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method

UNIT – 3 **6 Hours**

Simplex Method – 2: Adapting to other model forms; Post optimality analysis; Computer implementation
 Foundation of the simplex method.

UNIT – 4 **7 Hours**

Simplex Method – 2, Duality Theory: The revised simplex method, a fundamental insight.
 The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms

PART - B

UNIT – 5 **7 Hours**

Duality Theory and Sensitivity Analysis, Other Algorithms for LP : The role of duality in sensitive analysis; The essence of sensitivity analysis;

Applying sensitivity analysis. The dual simplex method; Parametric linear programming; The upper bound technique.

UNIT – 6

7 Hours

Transportation and Assignment Problems: The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.

UNIT – 7

6 Hours

Game Theory, Decision Analysis: Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions.

Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

UNIT – 8

6 Hours

Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8th Edition, Tata McGraw Hill, 2005. (Chapters: 1, 2, 3.1 to 3.4, 4.1 to 4.8, 5, 6.1 to 6.7, 7.1 to 7.3, 8, 13, 14, 15.1 to 15.4)

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007.

SIGNALS AND SYSTEMS

Subject Code: 10CS662

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction: Definitions of a signal and a system; Classification of signals; Basic operations on signals; Elementary signals.

UNIT – 2 **7 Hours**
Systems, Time-domain representations – 1: Systems viewed as interconnections of operations; Properties of systems; Convolution; Impulse response representation; Properties of impulse response representation.

UNIT – 3 **6 Hours**
Time domain representation – 2: Differential and difference equation representations; Block diagram representations.

UNIT – 4 **6 Hours**
Fourier Representation – 1: Fourier representation: Introduction; Fourier representations for four signal classes; Orthogonality of complex sinusoidal signals.

PART – B

UNIT – 5 **6 Hours**
Fourier Representation -2: DTFS representations; Continuous-time Fourier-series representations; DTFT and FT representations; Properties of Fourier representations.

UNIT – 6 **7 Hours**
Application of Fourier representations – 1: Frequency response of LTI systems; Solution of differential and difference equations using system function.

UNIT – 7 **7 Hours**
Applications of Fourier Representations – 2, Z-Transforms – 1: Fourier transform representations for periodic signals; Sampling of continuous time signals and signal reconstruction.
Introduction to Z-transform; Properties of ROC; Properties of Z-transforms; Inversion of Z-transforms

UNIT –Z– 8 **6 Hours**
Transforms – 2: Transforms analysis of LTI systems; Transfer function; Stability and causality; Unilateral Z-transforms and its application to solve difference equations

Text Books:

1. Simon Haykin and Barry Van Veen: Signals and Systems, 2nd Edition, Wiley India, 2007.
(Chapters: 1.1 to 1.8, 2.2 to 2.5, 3.1 to 3.6, 4.2 to 4.3, 4.7, 7.1 to 7.6, 7.8)

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab: Signals and Systems, 2nd Edition, PHI, 1997, Indian reprint 2009.
2. Ganesh Rao D and Satish Tunga: Signals and Systems - A Simplified Approach, Sanguine Technical Publishers, 2003-04.

DATA COMPRESSION

Subject Code: 10CS663
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT –1 7 Hours

Introduction, Lossless Compression -1: Compression techniques; Modeling and coding.

Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle.

Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression.

UNIT – 2 6 Hours

Lossless Compression – 2: Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42.

Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresolution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

UNIT – 3 6 Hours

Basics of Lossy Coding: Some mathematical concepts: Overview; Introduction; Distortion criteria; Models.

Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.

UNIT – 4 7 Hours

Vector Quantization, Differential Encoding: Vector quantization: Overview; Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm.

Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.

PART - B

UNIT – 5

7 Hours

Some Mathematical Concepts, Transform coding: Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z- transform. Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT.

UNIT – 6

6 Hours

Subband Coding, Audio Coding: Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression. Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.

UNIT – 7

6 Hours

Wavelet-Based Compression: Overview; Introduction; Wavelets; Multiresolution and the scaling function; Implementation using Filters; Image compression; Embedded zerotree coder; Set partitioning in hierarchical trees; JPEG 2000.

UNIT – 8

7 Hours

Video Compression: Overview; Introduction; Motion compensation; Video signal representation; H.261; Model-based coding; Asymmetric applications; MPEG-1 and MPEG-2; H.263; H.264, MPEG-4 and advanced video coding; Packet video.

Text Books:

1. Khalid Sayood: Introduction to Data Compression, 3rd Edition, Elsevier, 2006. (Chapters 1, 2 excluding 2.2.1 and 2.4.3, 3.1, 3.2, 3.2.1, 3.8.2, 5, 7.1 to 7.5, 7.6, 7.6.1, 7.6.2, 8.1 to 8.3, 8.6, 9.1 to 9.5, 10.1 to 10.4, 11, 12.6 to 12.9, 13, 14.1 to 14.4, 14.9 to 14.12, 15, 16, 18.1 to 18.13)

Reference Books:

1. D. Salomon: Data Compression: The Complete Reference, Springer, 1998.

PATTERN RECOGNITION

Subject Code: 10CS664

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT – 2

7 Hours

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT – 3

7 Hours

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT – 4

6 Hours

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; k_n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

PART – B

UNIT – 5

7 Hours

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT – 6

6 Hours

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

UNIT – 7

6 Hours

Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

UNIT – 8**7 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

Text Books:

1. Richard O. Duda, Peter E. Hart, and David G. Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.

Reference Books:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

STOCHASTIC MODELS AND APPLICATIONS**Subject Code: 10CS665****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****6 Hours**

Introduction – 1: Axioms of probability; Conditional probability and independence; Random variables; Expected value and variance; Moment-Generating Functions and Laplace Transforms; conditional expectation; Exponential random variables.

UNIT – 2**6 Hours**

Introduction – 2: Limit theorems; Examples: A random graph; The Quicksort and Find algorithms; A self-organizing list model; Random permutations.

UNIT – 3**7 Hours**

Probability Bounds, Approximations, and Computations: Tail probability inequalities; The second moment and conditional expectation inequality; probability bounds via the Importance sampling identity; Poisson random variables and the Poisson paradigm; Compound Poisson random variables.

UNIT – 4**7 Hours**

Markov Chains: Introduction; Chapman-Kologorov Equations; Classification of states; Limiting and stationary probabilities; some

applications; Time-Reversible Markov Chains; Markov Chain Monte Carlo methods.

PART – B

UNIT – 5

6 Hours

The Probabilistic Method: Introduction; Using probability to prove existence; Obtaining bounds from expectations; The maximum weighted independent set problem: A bound and a random algorithm; The set covering problem; Antichains; The Lovasz Local lemma; A random algorithm for finding the minimal cut in a graph.

UNIT – 6

6 Hours

Martingales: Martingales: Definitions and examples; The martingale stopping theorem; The Hoeffding-Azuma inequality; Sub-martingales.

UNIT – 7

7 Hours

Poisson Processes, Queuing Theory – 1: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times
Queuing Theory: Introduction; Preliminaries; Exponential models

UNIT – 8

7 Hours

Queuing Theory – 2: Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

Text Books:

1. Sheldon M. Ross: Probability Models for Computer Science, Elsevier, 2002.

Reference Books:

1. B. R. Bhat: Stochastic Models Analysis and Applications, New Age International, 2000.
2. Scott L. Miller, Donald G. Childers: Probability and Random Processes with Applications to Signal Processing and Communications, Elsevier, 2004.

PROGRAMMING LANGUAGES

Subject Code: 10CS666

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction; Names, Scopes, and Bindings: The art of language design; Programming language spectrum; Why study programming languages? Compilation and interpretation; Programming environments.

Names, scope, and bindings: The notion of binding time; Object lifetime and storage management; Scope rules; Implementing scope; The meaning of names within a scope; The binding of referencing environments; Macro expansion.

UNIT – 2

7 Hours

Control Flow: Expression evaluation; Structured and unstructured flow; Sequencing; Selection; Iteration; Recursion; Non-determinacy

UNIT – 3

6 Hours

Data Types: Type systems; Type checking; Records and variants; Arrays; Strings; Sets; Pointers and recursive types; Lists; Files and Input/Output; Equality testing and assignment.

UNIT – 4

6 Hours

Subroutines and Control Abstraction: Review of stack layout; Calling sequences; Parameter passing; Generic subroutines and modules; Exception handling; Coroutines; Events.

PART – B

UNIT – 5

6 Hours

Data Abstraction and Object Orientation: Object oriented programming; Encapsulation and Inheritance; Initialization and finalization; Dynamic method binding; Multiple inheritance; Object oriented programming revisited.

UNIT – 6**7 Hours**

Functional Languages, and Logic Languages: Functional Languages: Origins; Concepts; A review/overview of scheme; Evaluation order revisited; Higher-order functions; Functional programming in perspective. Logic Languages: Concepts; Prolog; Logic programming in perspective.

UNIT – 7**6 Hours**

Concurrency: Background and motivation; Concurrency programming fundamentals; Implementing synchronization; Language-level mechanisms; Message passing.

UNIT – 8**7 Hours**

Run-Time Program Management: Virtual machines; Late binding of machine code; Inspection/introspection.

Text Books:

1. Michael L. Scott: Programming Language Pragmatics, 3rd Edition, Elsevier, 2009.
(Chapters 1.1 to 1.5, 3.1 to 3.7, 6 excluding the sections on CD, 7 excluding the ML type system, 8, 9, 10 excluding the sections on CD, 11 excluding the sections on CD, 12, 15. Note: Text Boxes titled Design & Implementation are excluded)

Reference Books:

1. Ravi Sethi: Programming languages Concepts and Constructs, 2nd Edition, Pearson Education, 1996.
2. R Sebesta: Concepts of Programming Languages, 8th Edition, Pearson Education, 2008.
3. Allen Tucker, Robert Nonan: Programming Languages, Principles and Paradigms, 2nd Edition, Tata McGraw-Hill, 2007.

COMPUTER GRAPHICS AND VISUALIZATION LABORATORY**Subject Code: 10CSL67****I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50****PART - A****Design, develop, and implement the following programs in C / C++**

1. Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

2. Program to implement Liang-Barsky line clipping algorithm.
3. Program to draw a color cube and spin it using OpenGL transformation matrices.
4. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.
5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
6. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
7. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.
8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
10. Program to display a set of values $\{f_{ij}\}$ as a rectangular mesh.

PART - B

Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

Note:

1. Any question from Part A may be asked in the examination.
2. A report of about 10 – 12 pages on the package developed in Part B, duly certified by the department must be submitted during examination.

Instructions:

In the examination, one exercise from Part A is to be asked for a total of 30 marks. The package developed under Part B has to be evaluated for a total of 20 marks.

UNIX SYSTEM PROGRAMMING AND COMPILER DESIGN LABORATORY

Subject Code: 10CSL68

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

List of Experiments for USP: Design, develop, and execute the following programs

1. Write a C/C++ POSIX compliant program to check the following limits:
 - (i) No. of clock ticks
 - (ii) Max. no. of child processes
 - (iii) Max. path length
 - (iv) Max. no. of characters in a file name
 - (v) Max. no. of open files/ process
2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.
3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.
4. Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5.
 - a) Write a C/C++ program that outputs the contents of its Environment list
 - b) Write a C / C++ program to emulate the unix **ln** command
6. Write a C/C++ program to illustrate the race condition.
7. Write a C/C++ program that creates a zombie and then calls system to execute the **ps** command to verify that the process is zombie.
8. Write a C/C++ program to avoid zombie process by forking twice.
9. Write a C/C++ program to implement the **system** function.

10. Write a C/C++ program to set up a real-time clock interval timer using the **alarm** API.

List of Experiments for Compiler Design: Design, develop, and execute the following programs.

11. Write a C program to implement the syntax-directed definition of “if E then S1” and “if E then S1 else S2”. (Refer Fig. 8.23 in the text book prescribed for 06CS62 Compiler Design, Alfred V Aho, Ravi Sethi, and Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007).
12. Write a yacc program that accepts a regular expression as input and produce its parse tree as output.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VII

SEMESTER

OBJECT-ORIENTED MODELING AND DESIGN

Subject Code: 10CS71
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history

Modeling as Design Technique: Modeling; abstraction; The three models.

Class Modeling: Object and class concepts; Link and associations concepts;

Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

UNIT – 2

6 Hours

Advanced Class Modeling, State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – 3 **6 Hours**

Advanced State Modeling, Interaction Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.

Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

UNIT – 4 **7 Hours**

Process Overview, System Conception, Domain Analysis: Process Overview: Development stages; Development life cycle.

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

PART – B

UNIT – 5 **7 Hours**

Application Analysis, System Design: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

UNIT – 6 **7 Hours**

Class Design, Implementation Modeling, Legacy Systems: Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.

Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – 7 **6 Hours**

Design Patterns – 1: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description
Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

UNIT – 8

6 Hours

Design Patterns – 2, Idioms: Management Patterns: Command processor; View handler.

Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
(Chapters 1 to 17, 23)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 1, 3.5, 3.6, 4)

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley- Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

EMBEDDED COMPUTING SYSTEMS

Sub Code: 10CS72
Hrs/Week: 04
Total Hrs: 52

IA Marks :25
Exam Hours :03
Exam Marks :100

PART- A

UNIT – 1 **6 Hours**

Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design

Design Example: Model Train Controller.

UNIT – 2 **7 Hours**

Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

UNIT – 3 **6 Hours**

Bus-Based Computer Systems: CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis

Design Example: Alarm Clock.

UNIT – 4 **7 Hours**

Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

PART- B

UNIT – 5 **6 Hours**

Real Time Operating System (RTOS) Based Design – 1: Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization.

UNIT – 6 **6 Hours**

RTOS-Based Design - 2: Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine

UNIT – 7

7 Hours

Distributed Embedded Systems: Distributed Network Architectures, Networks for Embedded Systems: I2C Bus, CAN Bus, SHARC Link Ports, Ethernet, Myrinet, Internet, Network Based Design. Design Example: Elevator Controller.

UNIT – 8

7 Hours

Embedded Systems Development Environment: The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler /Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.

Text Books:

1. Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 2nd Edition, Elsevier, 2008.
2. Shibu K V: Introduction to Embedded Systems, Tata McGraw Hill, 2009
(Chapters 10, 13)

Reference Books:

1. James K. Peckol: Embedded Systems, A contemporary Design Tool, Wiley India, 2008
2. Tammy Neorgaard: Embedded Systems Architecture, Elsevier, 2005.

PROGRAMMING THE WEB

Subject Code: 10CS73

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

UNIT – 1

6 Hours

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.

UNIT – 2**7 Hours****XHTML – 2, CSS: XHTML (continued):** Lists, Tables, Forms, Frames

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution.

UNIT – 3**6 Hours**

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

UNIT – 4**7 Hours****Javascript and HTML Documents, Dynamic Documents with Javascript:**

The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification.

Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

PART - B**UNIT – 5****6 Hours**

XML: Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.

UNIT – 6**7 Hours**

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.

The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

Database access with Perl and MySQL

UNIT – 7**6 Hours**

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control

statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT – 8

7 Hours

Ruby, Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
(Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

ADVANCED COMPUTER ARCHITECTURES

Subject Code: 10CS74

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Fundamentals Of Computer Design: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

UNIT – 2

6 Hours

Pipelining: Introduction; Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

UNIT – 3

7 Hours

Instruction –Level Parallelism – 1: ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with

prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation.

UNIT – 4

7 Hours

Instruction –Level Parallelism – 2: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

PART - B

UNIT – 5

7 Hours

Multiprocessors and Thread –Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared-memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency

UNIT – 6

6 Hours

Review of Memory Hierarchy: Introduction; Cache performance; Cache Optimizations, Virtual memory

UNIT – 7

6 Hours

Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

UNIT – 8

7 Hours

Hardware and Software for VLIW and EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

Text Books:

1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 4th Edition, Elsevier, 2007.
(Chapter. 1.1 to 1.9, 2.1 to 2.10, 4.1to 4.6, 5.1 to 5.4, Appendix A, Appendix C, Appendix G)

Reference Books:

1. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability, 2nd Edition, Tata Mc Graw Hill, 2010.

2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

ADVANCED DBMS

Subject Code: 10CS751

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Overview of Storage and Indexing, Disks and Files: Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning
Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats

UNIT – 2

7 Hours

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

UNIT – 3

6 Hours

Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, comparisons

UNIT – 4

6 Hours

Overview of Query Evaluation, External Sorting : The system catalog; Introduction to operator evaluation; Algorithms for relational operations; Introduction to query optimization; Alternative plans: A motivating example; what a typical optimizer does.
When does a DBMS sort data? A simple two-way merge sort; External merge sort

PART - B

UNIT – 5

6 Hours

Evaluating Relational Operators : The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering

UNIT – 6**7 Hours**

A Typical Relational Query Optimizer: Translating SQL queries in to Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans; Nested sub-queries; other approaches to query optimization.

UNIT – 7**7 Hours**

Physical Database Design and Tuning: Introduction; Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.

UNIT – 8**6 Hours**

More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
(Chapters 8, 9, 10, 11, 12, 13.1 to 13.3, 14, 15, 20)
2. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
(Chapter 30)

Reference Books:

1. Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.

DIGITAL SIGNAL PROCESSING**Subject Code: 10CS752****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****7 Hours**

The Discrete Fourier Transform: Its Properties and Applications : Frequency Domain Sampling; The Discrete Fourier Transform: Frequency Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to other Transforms. Properties of the DFT: Periodicity, Linearity and Symmetry Properties, Multiplication of Two DFT's and Circular Convolution, Additional DFT Properties; Linear Filtering

Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.

UNIT – 2

7 Hours

Efficient Computation of the DFT: Fast Fourier Transform Algorithms:

Efficient Computation of the DFT: FFT Algorithms : Direct Computation of the DFT, Divide-and-Conquer Approach to Computation of the DFT, Radix-2 FFT Algorithms, Radix-4 FFT Algorithms, Split-Radix FFT Algorithms, Implementation of FFT Algorithms.

Applications of FFT Algorithms: Efficient computation of the DFT of Two Real Sequences, Efficient computation of the DFT of a $2N$ -Point Real Sequence, Use of the FFT Algorithm in Linear filtering and Correlation.

A Linear filtering approach to Computation of the DFT: The Goertzel Algorithm, The Chirp-Z Transform Algorithm.

Quantization Effects in the Computation of the DFT: Quantization Errors in the Direct Computation of the DFT, Quantization Errors in FFT Algorithms.

UNIT – 3

6 Hours

Implementation of Discrete-Time Systems – 1: Structures for the Realization of Discrete-Time Systems

Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Lattice and Lattice-Ladder Structures for IIR Systems.

UNIT – 4

6 Hours

Implementation of Discrete-Time Systems – 2: State-Space System Analysis and Structures: State-Space Descriptions of Systems Characterized by Difference Equations, Solution of the State-Space Equations, Relationships between Input-Output and State-Space Descriptions, State-Space Analysis in the Z-Domain, Additional State-Space Structures.

Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Numbers, Errors Resulting from Rounding and Truncation.

PART – B

UNIT – 5

6 Hours

Implementation of Discrete-Time Systems – 3: Quantization of Filter Coefficients: Analysis of Sensitivity to Quantization of Filter Coefficients, Quantization of Coefficients in FIR Filters

Round-Off Effects in Digital Filters: Limit-Cycle Oscillations in Recursive Systems, Scaling to Prevent Overflow, Statistical Characterization of Quantization effects in Fixed-Point Realizations of Digital Filters.

UNIT – 6

7 Hours

Design of Digital Filters – 1: General Considerations: Causality and its Implications, Characteristics of Practical Frequency-Selective Filters.

Design of FIR Filters: Symmetric And Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of FIR Differentiators, Design of Hilbert Transformers, Comparison of Design Methods for Linear-Phase FIR filters.

UNIT – 7

6 Hours

Design of Digital Filters – 2: Design of IIR Filters from Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, The Matched-Z Transformation, Characteristics of commonly used Analog Filters, Some examples of Digital Filters Designs based on the Bilinear Transformation.

UNIT – 8

7 Hours

Design of Digital Filters – 3: Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

Design of Digital Filters based on Least-Squares method: Padé Approximations method, Least-Square design methods, FIR least-Squares Inverse (Wiener) Filters, Design of IIR Filters in the Frequency domain.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis: Digital Signal Processing, 3rd Edition, Pearson Education, 2003. (Chapters 5, 6, 7 and 8)

Reference Books:

1. Paulo S. R. Diniz, Eduardo A. B. da Silva And Sergio L. Netto: Digital Signal Processing: System Analysis and Design, Cambridge University Press, 2002.
2. Sanjit K. Mitra: Digital Signal Processing: A Computer Based Approach, Tata Mcgraw-Hill, 2001.
3. Alan V Oppenheim and Ronald W Schaffer: Digital Signal Processing, PHI, Indian Reprint, 2008.

JAVA AND J2EE

Subject Code:10CS753

Hours/Week: 4

Total Hours: 52

IA Marks: 25

Exam Marks: 100

Exam Hours: 3

PART - A

UNIT – 1

6 Hours

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs.

Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers.

Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Type casting; Strings

Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT – 2

6 Hours

Classes, Inheritance, Exceptions, Applets : Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes.

Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading.

Exception handling: Exception handling in Java.

The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT – 3

7 Hours

Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

UNIT – 4

7 Hours

Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

PART – B

UNIT – 5

6 Hours

Java 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE

The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

UNIT – 6

7 Hours

Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT – 7

6 Hours

JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

UNIT – 8

7 Hours

Enterprise Java Beans: Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Text Books:

1. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
(Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)
2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.
(Chapters 5, 6, 11, 12, 15)

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.

MULTIMEDIA COMPUTING

Subject Code: 10CS754

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases.

Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams.

Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT – 2

7 Hours

Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options.

Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language.

UNIT – 3

7 Hours

Data Compression – 1: Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT- based Mode, Lossless Mode, Hierarchical Mode

UNIT – 4**6 Hours**

Data Compression – 2: H.261 (Px64) and H.263: Image Preparation, Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG-2, MPEG-4, MPEG-7; Fractal Compression.

PART - B**UNIT – 5****6 Hours**

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM- Based Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc.

UNIT – 6**6 Hours**

Content Analysis : Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

UNIT – 7**6 Hours**

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN

UNIT – 8**7 Hours**

Multimedia Application Design : Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

Text Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008.
(Chapters 2, 3, 4, 5, 6, 7, 8, 9)
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.
(Chapters 1, 3, 7)

Reference Books:

1. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.
2. Nalin K Sharad: Multimedia Information Networking, PHI, 2002.

DATA WAREHOUSING AND DATA MINING

Subject Code: 10CS755
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Data Warehousing:

Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata

UNIT – 2

6 Hours

Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Softwares.

UNIT – 3

6 Hours

Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications

UNIT – 4

8 Hours

Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP Growth Algorithm, Evaluation of Association Patterns

PART - B

UNIT – 5

6 Hours

Classification - 1 : Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

UNIT – 6

6 Hours

Classification - 2 : Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of clarification methods, Evaluation criteria for classification methods, Multiclass Problem.

UNIT – 7**8 Hours**

Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

UNIT – 8**6 Hours**

Web Mining: Introduction, Web content mining, Text Mining, Unstructured Text, Text clustering, Mining Spatial and Temporal Databases.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2005.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Reference Books:

1. Arun K Pujari: Data Mining Techniques 2nd Edition, Universities Press, 2009.
2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.
3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing, Mc GrawHill Publisher, 1997.

NEURAL NETWORKS**Subject Code: 10CS756****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****7 Hours****Introduction**

What is a Neural Network?, Human Brain, Models of Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks.

UNIT – 2**6 Hours****Learning Processes – 1**

Introduction, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit Assignment problem, Learning with a Teacher, Learning without a Teacher, Learning tasks, Memory, Adaptation.

UNIT – 3**7 Hours**

Learning Processes – 2, Single Layer Perceptrons: Statistical nature of the learning process, Statistical learning theory, Approximately correct model of learning.

Single Layer Perceptrons: Introduction, Adaptive filtering problem, Unconstrained optimization techniques, Linear least-squares filters, Least-mean square algorithm, Learning curves, Learning rate annealing techniques, Perceptron, Perceptron convergence theorem, Relation between the Perceptron and Bayes classifier for a Gaussian environment.

UNIT – 4

6 Hours

Multilayer Perceptrons – 1: Introduction, Some preliminaries, Back-propagation Algorithm, Summary of back-propagation algorithm, XOR problem, Heuristics for making the back-propagation algorithm perform better, Output representation and decision rule, Computer experiment, Feature detection, Back-propagation and differentiation.

PART - B

UNIT – 5

7 Hours

Multilayer Perceptrons – 2: Hessian matrix, Generalization, approximation of functions, Cross validation, Network pruning techniques, virtues and limitations of back- propagation learning, Accelerated convergence of back propagation learning, Supervised learning viewed as an optimization problem, Convolution networks.

UNIT – 6

6 Hours

Radial-Basic Function Networks – 1: Introduction, Cover's theorem on the separability of patterns, Interpolation problem, Supervised learning as an ill-posed Hypersurface reconstruction problem, Regularization theory, Regularization networks, Generalized radial-basis function networks, XOR problem, Estimation of the regularization parameter.

UNIT – 7

6 Hours

Radial-Basic Function Networks – 2, Optimization – 1: Approximation properties of RBF networks, Comparison of RBF networks and multilayer Perceptrons, Kernel regression and it's relation to RBF networks, Learning strategies, Computer experiment.

Optimization using Hopfield networks: Traveling salesperson problem, Solving simultaneous linear equations, Allocating documents to multiprocessors.

UNIT – 8

7 Hours

Optimization Methods – 2:

Iterated gradient descent, Simulated Annealing, Random Search, Evolutionary computation- Evolutionary algorithms, Initialization, Termination criterion, Reproduction, Operators, Replacement, Schema theorem

Text Books:

1. Simon Haykin: Neural Networks - A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999.
(Chapters 1.1-1.8, 2.1-2.15, 3.1-3.10, 4.1-4.19, 5.1-5.14)
2. Kishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.
(Chapters 7.1-7.5)

Reference Books:

1. B.Yegnanarayana: Artificial Neural Networks, PHI, 2001.

C# PROGRAMMING AND .NET

Subject Code: 10CS761

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

The philosophy of .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime

UNIT – 2

6 Hours

Building C# Applications: The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET

IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class

UNIT – 3

8 Hours

C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces

UNIT – 4

6 Hours

Object- Oriented Programming with C#: Forms Defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

PART – B

UNIT – 5

6 Hours

Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception(System. System Exception), Custom Application-Level Exception(System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of “new”, The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

UNIT – 6

6 Hours

Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (I Comparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type)

UNIT – 7

8 Hours

Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer . Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

UNIT – 8

6 Hours

Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly

Text Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, 4th Edition, Wiley India, 2009.
Chapters: 1 to 11 (up to pp.369)
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.

(Programming Examples 3.7, 3.10, 5.5, 6.1, 7.2, 7.4, 7.5, 7.6, 8.1, 8.2, 8.3, 8.5, 8.7, 8.8, 9.1, 9.2, 9.3, 9.4, 10.2, 10.4, 11.2, 11.4, 12.1, 12.4, 12.5, 12.6, 13.1, 13.2, 13.3, 13.6, 14.1, 14.2, 14.4, 15.2, 15.3, 16.1, 16.2, 16.3, 18.3, 18.5, 18.6)

Reference Books:

1. Tom Archer: Inside C#, WP Publishers, 2001.
2. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill, 2004.

DIGITAL IMAGE PROCESSING

Subject Code: 10CS762

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Digitized Image and its properties: Basic concepts, Image digitization, Digital image properties

UNIT – 2

7 Hours

Image Preprocessing: Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3

7 Hours

Segmentation – 1: Thresholding, Edge-based segmentation.

UNIT – 4

7 Hours

Segmentation – 2: Region based segmentation, Matching.

PART – B

UNIT – 5

7 Hours

Image Enhancement: Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT – 6

6 Hours

Image Compression: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT – 7**7 Hours**

Shape representation: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 8**6 Hours**

Morphology: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

Text Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision, 2nd Edition, Thomson Learning, 2001.
(Chapters 2, 4.1 to 4.3, 5.1 to 5.4, 6, 11.1 to 11.4, 11.7)
2. Rafael C Gonzalez and Richard E Woods: Digital Image Processing, 3rd Edition, Pearson Education, 2003.
(Chapters 3.1 to 3.7, 4.1 to 4.5, 8.1 to 8.5)

Reference Books:

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI, 1997, Indian Reprint 2009.
2. B.Chanda, D Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2002.

GAME THEORY**Subject Code: 10CS763****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****8 Hours**

Introduction, Strategic Games: What is game theory? The theory of rational choice; Interacting decision makers.

Strategic games; Examples: The prisoner’s dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria.

UNIT – 2**6 Hours**

Mixed Strategy Equilibrium: Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed, Illustration: Expert Diagnosis; Equilibrium in a single population, Illustration: Reporting a crime; The formation of players' beliefs; Extensions; Representing preferences by expected payoffs.

UNIT – 3**6 Hours**

Extensive Games: Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg's model of duopoly, Buying votes.

UNIT – 4**6 Hours**

Extensive games: Extensions and Discussions: Extensions: Allowing for simultaneous moves, Illustrations: Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction.

PART – B**UNIT – 5****7 Hours**

Bayesian Games, Extensive Games with Imperfect Information: Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations.

Extensive games with imperfect information; Strategies; Nash equilibrium; Beliefs and sequential equilibrium; Signaling games; Illustration: Strategic information transmission.

UNIT – 6**7 Hours**

Strictly Competitive Games, Evolutionary Equilibrium: Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games.

Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio.

UNIT – 7**6 Hours**

Iterated Games: Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Some Nash equilibria of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.

UNIT – 8

6 Hours

Coalitional Games and Bargaining: Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, Exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining

Text Books:

1. Martin Osborne: An Introduction to Game Theory, Oxford University Press, Indian Edition, 2004.
(Listed topics only from Chapters 1 to 11, 13, 14, 16)

Reference Books:

1. Roger B. Myerson: Game Theory: Analysis of Conflict, Harvard University Press, 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green: Microeconomic Theory. Oxford University Press, New York, 1995.
3. Philip D. Straffin, Jr.: Game Theory and Strategy, The Mathematical Association of America, January 1993.

ARTIFICIAL INTELLIGENCE

Subject Code: 10CS764

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

UNIT – 2

7 Hours

Informed Search, Exploration, Constraint Satisfaction, Adversarial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search

for CSPs. Adversarial search: Games; Optimal decisions in games; Alpha-Beta pruning.

UNIT – 3

6 Hours

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT – 4

6 Hours

First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting

PART – B

UNIT – 5

6 Hours

Inference in First-Order Logic – 2: Forward chaining; Backward chaining; Resolution.

UNIT – 6

7 Hours

Knowledge Representation: Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

UNIT – 7

7 Hours

Planning, Uncertainty, Probabilistic Reasoning: Planning: The problem; Planning with state-space approach; Planning graphs; Planning with propositional logic.

Uncertainty: Acting under certainty; Inference using full joint distributions; Independence; Bayes' rule and its use.

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks.

UNIT – 8

6 Hours

Learning, AI: Present and Future: Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory.

AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.
(Chapters 1.1, 2, 3.1 to 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1, 6.2, 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6, 14.1, 14.2, 14.3, 14.4, 18, 27)

Reference Books:

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2009.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

STORAGE AREA NETWORKS

Subject Code: 10CS765

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART –A

UNIT - 1

7 Hours

Introduction to Information Storage and Management, Storage System Environment: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle

Components of Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance.

UNIT - 2

6 Hours

Data Protection, Intelligent Storage system: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares

Components of an Intelligent Storage System, Intelligent Storage Array

UNIT - 3

7 Hours

Direct-Attached Storage, SCSI, and Storage Area Networks: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies.

UNIT - 4

6 Hours

NAS, IP SAN: General – Purpose Service vs. NAS Devices, Benefits of NAS, NAS File I / O, Components of NAS, NAS Implementations, NAS

File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. iSCSI, FCIP.

PART - B

UNIT - 5

6 Hours

Content-Addressed Storage, Storage Virtualization: Fixed Content and Archives, Types of Archive, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples

Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualizations Configurations, Storage Virtualization Challenges, Types of Storage Virtualization

UNIT - 6

6 Hours

Business Continuity, Backup and Recovery: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions.

Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies.

UNIT - 7

7 Hours

Local Replication, Remote Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure.

UNIT - 8

7 Hours

Securing the Storage Infrastructure, Managing the Storage Infrastructure: Storage Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking

Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution.

Text Books:

1. G. Somasundaram, Alok Shrivastava (Editors): Information Storage and Management, EMC Education Services, Wiley India, 2009.

Reference Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
2. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003.

3. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002.

FUZZY LOGIC

Subject Code: 10CS766
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Classical Sets and Fuzzy Sets: Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity.

Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions

Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

UNIT – 2

6 Hours

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations - Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

UNIT – 3

6 Hours

Membership Functions: Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

UNIT – 4

7 Hours

Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic: Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods

Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers

Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

PART - B

UNIT – 5

6 Hours

Classical Logic and Fuzzy Logic: Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR, Logical Proofs, Deductive Inferences. Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, Other forms of the Implication Operation, Other forms of the Composition Operation

UNIT – 6

6 Hours

Fuzzy Rule- Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference

UNIT – 7

7 Hours

Fuzzy Decision Making : Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multiobjective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.

UNIT – 8

7 Hours

Fuzzy Classification: Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering

Text Books:

1. Timothy J. Ross: Fuzzy Logic with Engineering Applications, 2nd Edition, Wiley India, 2006..
(Chapter 1 (pp 1-14), Chapter 2 (pp 17-34), Chapter 3 (pp 46-70), Chapter 4 (pp 87-122), Chapter 5 (pp 130-146), Chapter 6 (pp 151-178), Chapter 7 (pp 183-210), Chapter 8 (pp 232-254), Chapter 9 (pp 313-352), Chapter 10 (pp 371 – 400))

Reference Books:

1. B Kosko: Neural Networks and Fuzzy systems: A Dynamical System approach, PHI, 1991.

Networks Laboratory

Subject Code: 10CSL77

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

Note: Student is required to solve one problem from PART-A and one problem from PART-B. The questions are allotted based on lots. Both questions carry equal marks.

PART A – Simulation Exercises

The following experiments shall be conducted using either NS228/OPNET or any other suitable simulator.

1. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network with the links connected as follows:
n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
5. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

PART-B

Implement the following in C/C++:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program for distance vector algorithm to find suitable path for transmission.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.

10. Implement the above program using as message queues or FIFOs as IPC channels.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Note:

In the examination, a combination of one problem has to be asked from Part A for a total of 25 marks and one problem from Part B has to be asked for a total of 25 marks. The choice must be based on random selection from the entire lots.

Web Programming Laboratory

Subject Code: 10CSL78

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
 - a) Input: A number n obtained using prompt
Output: The first n Fibonacci numbers
 - b) Input: A number n obtained using prompt
Output: A table of numbers from 1 to n and their squares using **alert**
2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)
3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.
4. a) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include

USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

- b) Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.
5. a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc.
b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.
6. a) Write a Perl program to accept the User Name and display a greeting message randomly chosen from a list of 4 greeting messages.
b) Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a Perl program to display a digital clock which displays the current time of the server.
8. Write a Perl program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.
9. Write a PHP program to store current date-time in a COOKIE and display the „Last visited on” date-time on the web page upon reopening of the same page.
10. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
11. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
12. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VIII SEMESTER

SOFTWARE ARCHITECTURES

Subject Code: 10IS81

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

UNIT – 2

7 Hours

Architectural Styles and Case Studies: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Studies: Keyword in Context; Instrumentation software; Mobile robotics; Cruise control; Three vignettes in mixed style.

UNIT – 3

6 Hours

Quality: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

UNIT – 4

7 Hours

Architectural Patterns – 1: Introduction; From mud to structure: Layers, Pipes and Filters, Blackboard.

PART – B

UNIT – 5 **7 Hours**

Architectural Patterns – 2: Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control.

UNIT – 6 **6 Hours**

Architectural Patterns – 3: Adaptable Systems: Microkernel; Reflection.

UNIT – 7 **6 Hours**

Some Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT – 8 **7 Hours**

Designing and Documenting Software Architecture: Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

Text Books:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
(Chapters 1, 2, 4, 5, 7, 9)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 2, 3.1 to 3.4)
3. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2007.
(Chapters 1.1, 2, 3)

Reference Books:

1. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Pearson Education, 1995.

Web Reference: <http://www.hillside.net/patterns/>

SYSTEM MODELING AND SIMULATION

Sub Code: 10CS82	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT – 1 8 Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT – 2 6 Hours

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing. Simulation in Java; Simulation in GPSS

UNIT – 3 6 Hours

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT – 4 6 Hours

Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration..

PART – B

UNIT – 5 8 Hours

Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

UNIT – 6**6 Hours**

Input Modeling : Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – 7**6 Hours**

Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – 8**6 Hours**

Verification, Calibration, and Validation; Optimization: Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.
(Listed topics only from Chapters 1 to 12)

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007.

WIRELESS NETWORKS AND MOBILE COMPUTING**Sub Code: 10CS831****IA Marks : 25****Hrs/Week: 04****Exam Hours : 03****Total Hrs: 52****Exam Marks : 100****PART-A****UNIT – 1****6 Hours**

Mobile Computing Architecture: Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing.

UNIT – 2 **7 Hours**

Wireless Networks – 1: GSM and SMS: Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications

UNIT – 3 **6 Hours**

Wireless Networks – 2: GPRS : GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS

UNIT – 4 **7 Hours**

Wireless Networks – 3: CDMA, 3G and WiMAX: Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

PART - B

UNIT – 5 **6 Hours**

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6

UNIT – 6 **7 Hours**

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development : The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

UNIT – 7 **6 Hours**

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

UNIT – 8 **7 Hours**

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet

event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

Text Books:

1. Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2d Edition, Tata McGraw Hill, 2010
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

WEB 2.0 AND RICH INTERNET APPLICATIONS

Sub Code: 10CS832

Hrs/ Week: 04

Total Hours: 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT – 1

6 Hours

Introduction, Ajax – 1: Web 2.0 and Rich Internet Applications, Overview of Ajax, Examples of usage of Ajax: Updating web page text, Chatting in real time, Dragging and dropping, Downloading images. Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST, Using Ajax together with XML.

UNIT – 2

7 Hours

Ajax – 2: Handling multiple XMLHttpRequest objects in the same page, Using two XMLHttpRequest objects, Using an array of XMLHttpRequest objects, Using inner functions, Downloading JavaScript, connecting to Google Suggest, Creating google.php, Downloading from other domains with Ajax, HTML header request and Ajax, Defeating caching, Examples. Building XML and working with XML in JavaScript, Getting the document element, Accessing any XML element, Handling whitespace in Firefox, Handling cross-browser whitespace, Accessing XML data directly, Validating XML, Further examples of Rich Internet Applications with Ajax.

UNIT – 3**6 Hours**

Ajax – 3: Drawing user’s attention to downloaded text, Styling text, colors and background using CSS, Setting element location in the web pages, Setting the stacking order of web page elements, Further examples of using Ajax. Displaying all the data in an HTML form, Working with PHP server variables, Getting the data in to array format, Wrapping applications in to a single PHP page, Validating input from the user, Validating integers and text, DOM, Appending new elements to a web page using the DOM and Ajax, Replacing elements using the DOM, Handling timeouts in Ajax, Downloading images with Ajax, Example programs.

UNIT – 4**7 Hours**

Flex – 1 : Introduction: Understanding Flex Application Technologies, Using Flex Elements, Working with Data Services (Loading Data at Runtime), The Differences between Traditional and Flex Web Applications, Understanding How Flex Applications Work, Understanding Flex and Flash Authoring. Building Applications with the Flex Framework: Using Flex Tool Sets, Creating Projects, Building Applications, Deploying Applications Framework Fundamentals: Understanding How Flex Applications Are Structured, Loading and Initializing Flex Applications, Understanding the Component Life Cycles, Loading One Flex Application into Another Flex Application, Differentiating Between Flash Player and the Flex Framework, Caching the Framework, Understanding Application Domains, Localization, Managing Layout: Flex Layout Overview, Making Fluid Interfaces, Putting It All Together.

PART B**UNIT – 5****7 Hours**

Flex – 2: MXML: Understanding MXML Syntax and Structure, Making MXML Interactive Working with UI Components: Understanding UI Components, Buttons, Value Selectors, Text Components, List-Based Controls, Pop-Up Controls, Navigators, Control Bars Customizing Application Appearance: Using Styles, Skinning components, Customizing the preloader, Themes, Runtime CSS

UNIT – 6**6 Hours**

Flex – 3: ActionScript: Using ActionScript, MXML and ActionScript Correlations, Understanding ActionScript Syntax, Variables and Properties, Inheritance, Interfaces, Handling Events, Error Handling, Using XML

UNIT – 7**7 Hours**

Flex – 4: Managing State: Creating States, Applying States, Defining States, Adding and Removing Components, Setting Properties, Setting Styles,

Setting Event Handlers, Using Action Scripts to Define States, Managing Object Creation Policies, Handling State Events, Understanding State Life Cycles, When To Use States.Using Effects and Transitions: Using Effects, Creating Custom Effects, Using Transitions, Creating Custom Transitions.

UNIT – 8

6 Hours

Flex – 5: Working with Data: Using Data Models, Data Binding, Enabling Data Binding for Custom Classes, Data Binding Examples, Building data binding proxies. Validating and Formatting Data: Validating user input, Formatting Data.

Text Books:

1. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2009.
(Listed topics from Chapters 3, 4, 6, 7, 11, 12)
2. Chafic Kazon and Joey Lott: Programming Flex 3, O'Reilly, June 2009.
(Listed topics from Chapters 1 to 8, 12 to 15)

Reference Books:

1. Jack Herrington and Emily Kim: Getting Started with Flex 3, O'Reilly, 1st Edition, 2008.
2. Michele E. Davis and John A. Phillips: Flex 3 - A Beginner's Guide, Tata McGraw-Hill, 2008.
3. Colin Moock: Essential Actionscript 3.0, O'Reilly Publications, 2007.
4. Nicholas C Zakas et al : Professional Ajax, 2nd Edition, Wrox/Wiley India, 2008.

VLSI DESIGN AND ALGORITHMS

Sub Code: 10CS833

Hrs/Week: 04

Total Hrs: 52

IA Marks 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT 1

6 Hours

Digital Systems and VLSI: Why design Integrated Circuits? Integrated Circuits manufacturing, CMOS Technology, Integrated Circuit Design Techniques, IP-based Design.

UNIT 2

8 Hours

Fabrication and Devices: Fabrication Processes, Transistors, Wires and vias, SCMOS Design Rules, Layout design and tools.

UNIT 3 **6 Hours**

Logic Gates – 1: Combinatorial logic functions, Static Complementary gates, Switch Logic.

UNIT 4 **6 Hours**

Logic Gates – 2: Alternative gate Circuits, Low Power gates, Delay through resistive interconnect; Delay through inductive interconnect, Design for yield, Gates as IP.

PART - B

UNIT 5 **6 Hours**

Combinational Logic Networks: Standard cell-based layout, Combinatorial network delay, Logic and interconnect design, Power Optimization, Switch logic networks, Combinational logic testing.

UNIT 6 **6 Hours**

Sequential Machines: Latches and Flip-flops, Sequential systems and clocking disciplines, Clock generators, Sequential systems design, Power optimization, Design validation, Sequential testing.

UNIT 7 **6 Hours**

Architecture Design: Register Transfer design, High Level Synthesis, Architecture for Low Power, Architecture testing.

UNIT 8 **8 Hours**

Design Problems and Algorithms : Placement and Partitioning: Circuit Representation, Wire-length Estimation, Types of Placement Problems, Placement Algorithms, Constructive Placement, Iterative Improvement, Partitioning, The Kernighan-Lin Partitioning Algorithm. Floor Planning: Concepts, Shape functions and floor plan sizing. Routing: Types of Local Routing Problems, Area Routing, Channel Routing, Introduction to Global Routing, Algorithms for Global Routing

Text Books:

1. Wayne Wolf: Modern VLSI Design - IP-Based Design, 4th Edition, PHI Learning, 2009.
(Listed topics only from Chapters 1 to 5, and 8)
2. Sabih H. Gerez: Algorithms for VLSI Design Automation, Wiley India, 2007.
(Listed topics only from Chapters 7, 8, and 9)

NETWORK MANAGEMENT SYSTEMS

Sub Code: 10CS834	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT 1 7 Hours

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

UNIT 2 6 Hours

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

UNIT 3 6 Hours

SNMPv1 Network Management - 1 : Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview.

UNIT 4 7 Hours

SNMPv1 Network Management – 2: The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

PART - B

UNIT 5

6 Hours

SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications; ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

UNIT 6

6 Hours

Broadband Network Management: ATM Networks: Broadband Networks and Services, ATM Technology – Virtual Path-Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation, ATM Digital Exchange Interface Management.

UNIT 7

6 Hours

Broadband Network Management: Broadband Access Networks and Technologies – Broadband Access Networks, roadband Access Technology; HFCT Technology – The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

UNIT 8

8Hours

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem

Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

Text Books:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Edition, Pearson Education, 2010.

Reference Books:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

INFORMATION AND NETWORK SECURITY

Subject Code: 10CS835

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT 1

6 Hours

Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan

UNIT 2

6 Hours

Security Technology-1: Introduction; Physical design; Firewalls; Protecting Remote Connections

UNIT 3

6 Hours

Security Technology – 2: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

UNIT 4

8 Hours

Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

PART - B

UNIT 5 **8 Hours**
Introduction to Network Security, Authentication Applications: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs Kerberos, X.509 Directory Authentication Service.

UNIT 6 **6 Hours**
Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME

UNIT 7 **6 Hours**
IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 8 **6 Hours**
Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

Text Books:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005. (Chapters 5, 6, 7, 8; Exclude the topics not mentioned in the syllabus)
2. William Stallings: Network Security Essentials: Applications and Standards, 3rd Edition, Pearson Education, 2007. (Chapters: 1, 4, 5, 6, 7, 8)

Reference Book:

1. Behrouz A. Forouzan: Cryptography and Network Security, Special Indian Edition, Tata McGraw-Hill, 2007.

MICROCONTROLLER-BASED SYSTEMS

Subject Code: 10CS836
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1 **7 Hours**
Introduction, 8051 Assembly Language Programming – 1: Microcontrollers and embedded processors; Overview of the 8051 family 8051 Assembly Language Programming (ALP) -1: Inside the 8051; Introduction to 8051 ALP; Assembling and running an 8051 program; The

PC and ROM space in 8051; Data types, directives, flag bits, PSW register, register banks, and the stack.

UNIT 2

6 Hours

ALP – 2 : Jump and loop instructions; Call instructions; Time delay for various 8051 family members; I/O programming; I/O bit manipulation programming. Immediate and register addressing modes; Accessing memory using various addressing modes.

UNIT 3

7 Hours

ALP – 3 - Programming in C: Bit addresses for I/O and RAM; Extra 128 bytes of on-chip RAM in 8052. Arithmetic instructions; Signed numbers and arithmetic operations; Logic and compare instructions; rotate instruction and serialization; BCD, ASCII, and other application programs. Programming in C: Data types and time delays; I/O programming; Logic operations; Data conversion programs; Accessing code ROM space; Data serialization.

UNIT 4

6 Hours

Pin Description, Timer Programming: Pin description of 8051; Intel Hex file; Programming the 8051 timers; Counter programming; Programming Timers 0 and 1 in C.

PART – B

UNIT 5

6 Hours

Serial Port Programming, Interrupt Programming: Basics of serial communications; 8051 connections to RS232; Serial port programming in assembly and in C 8051 interrupts; Programming timer interrupts; Programming external hardware interrupts; Programming the serial communications interrupt; Interrupt priority in 8051 / 8052; Interrupt programming in C.

UNIT 6

7 Hours

Interfacing LCD, Keyboard, ADC, DAC and Sensors : LCE interfacing; Keyboard interfacing; Parallel and serial ADC; DAC interfacing; Sensor interfacing and signal conditioning

UNIT 7

7 Hours

Interfacing to External Memory, Interfacing with 8255: Memory address decoding; Interfacing 8031 / 8051 with external ROM; 8051 data memory space; Accessing external data memory in C. Interfacing with 8255; Programming 8255 in C.

UNIT 8

6 Hours

DS12887 RTC interfacing and Programming, Applications : DS12887 RTC interfacing; DS12887 RTC programming in C; Alarm, SQW, and IRQ features of DS12886 Relays and opto-isolators; Stepper motor interfacing; DC motor interfacing and PWM

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay: The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd Edition, Pearson Education,2008.

Reference Books:

1. Raj Kamal: Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education, 2007.
2. Dr. Ramani Kalpathi, Ganesh Raja: Microcontrollers and Applications, 1st Revised Edition, Sanguine - Pearson, 2010.

ADHOC NETWORKS

Sub Code: 10CS841	IA Marks	: 25
Hrs/Week: 04	Exam Hours	: 03
Total Hrs: 52	Exam Marks	: 100

PART – A

UNIT 1 **6 Hours**

Introduction: Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT 2

7 Hours

MAC – 1: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT 3 **6 Hours**

MAC – 2: Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4

7 Hours

Routing – 1: Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

PART- B

UNIT 5

6 Hours

Routing – 2: Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT 6

7 Hours

Transport Layer: Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7

6 Hours

Security: Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

UNIT 8

7 Hours

QoS: Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2005

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Adhoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

SOFTWARE TESTING

Subject Code: 10CS842

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT 1

6 Hours

A Perspective on Testing, Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 2

7 Hours

Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

UNIT 3

7 Hours

Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing, Guidelines and observations.

UNIT 4

6 Hours

Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.

PART – B

UNIT 5

7 Hours

System Testing, Interaction Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. Context of

interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing,.

UNIT 6

7 Hours

Process Framework: Validation and verification, Degrees of freedom, Varieties of software. Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback. The quality process, Planning and monitoring, Quality goals, Dependability properties, Analysis, Testing, Improving the process, Organizational factors.

UNIT 7

6 Hours

Fault-Based Testing, Test Execution: Overview, Assumptions in fault-based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Test Execution: Overview, from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.

UNIT 8

6 Hours

Planning and Monitoring the Process, Documenting Analysis and Test: Quality and process, Test and analysis strategies and plans, Risk planning, Monitoring the process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
(Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 15)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
(Listed topics only from Chapters 2, 3, 4, 16, 17, 20, 24)

REFERENCE BOOKS:

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopaldaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.
3. Brian Marrick: The Craft of Software Testing, Pearson Education, 1995.

ARM BASED SYSTEM DESIGN

Subject Code: 10CS843

I.A. Marks: 25

Hours/Week: 4

Exam Marks: 100

Total Hours: 52

Exam Hours: 3

PART – A

UNIT 1

6 Hours

Introduction: The RISC design philosophy; The ARN design philosophy; Embedded system hardware and software.ARM processor fundamentals: Registers; Current Program Status Register; Pipeline; Exceptions, interrupts and the Vector Table; Core extensions; Architecture revisions; ARM processor families.

UNIT 2

7 Hours

ARM Instruction Set and Thumb Instruction Set: ARM instruction set: Data processing instructions; Branch instructions; Load-store instructions; Software interrupt instruction; Program Status Register functions; Loading constants; ARmv5E extensions; Conditional execution.Thumb instruction set: Thumb register usage; ARM –Thumb interworking; Other branch instructions; Data processing instructions; Single-Register Load-Store instructions; Multiple-Register Load-Store instructions; Stack instructions; Software interrupt instruction.

UNIT 3

6 Hours

Writing and Optimizing ARM Assembly Code: Writing assembly code; Profiling and cycle counting; Instruction scheduling; Register allocation; Conditional execution; Looping constructs; Bit manipulation; Efficient switches; Handling unaligned data.

UNIT 4

7 Hours

Optimized Primitives: Double-precision integer multiplication; Integer normalization and count leading zeros; Division; Square roots; Transcendental functions; Endian reversal and bit operations; Saturated and rounded arithmetic; Random number generation.

PART - B

UNIT 5

7 Hours

Exception and Interrupt Handling: Exception handling; Interrupts and interrupt handling schemes

UNIT 6**7 Hours**

Caches : The memory hierarchy and the cache memory; Cache architecture; Cache policy; Coprocessor 15 and cache; Flusing and cleaning cache memory; Cache lockdown; Caches and software performance.

UNIT 7**6 Hours**

Memory – 1: Memory Protection Units: Protected regions; Initializing the MPU, cache and write buffer; Demonstration of an MPU system. Memory Management Units: Moving from MPU to an MMU; How virtual memory works; Details of the ARM MMU.

UNIT 8**6 Hours**

Memory – 2: Page tables; The translation lookaside buffer; Domains and memory access permission; The caches and write buffer; Coprocessor 15 and MMU configuration; The fast context switch extension.

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright: ARM System Developer's Guide – Designing and Optimizing System Software, Elsevier, 2004.

Reference Books:

1. David Seal (Editor): ARM Architecture Reference Manual, 2nd Edition, Addison-Wesley, 2001.
2. Steve Furber: ARM System-on-Chip Architecture, 2nd Edition, Addison-Wesley, 2000.

SERVICES ORIENTED ARCHITECTURE**Subject Code: 10CS844****I.A. Marks: 25****Hours/Week: 4****Exam Marks: 100****Total Hours: 52****Exam Hours: 3****PART – A****UNIT 1****7 Hours**

Introduction o SOA, Evolution of SOA: Fundamental SOA; Common Characteristics of contemporary SOA; Common tangible benefits of SOA; An SOA timeline (from XML to Web services to SOA); The continuing evolution of SOA (Standards organizations and Contributing vendors); The roots of SOA (comparing SOA to Past architectures).

UNIT 2**6 Hours**

Web Services and Primitive SOA : The Web services framework; Services (as Web services); Service descriptions (with WSDL); Messaging (with SOAP).

UNIT 3**6 Hours**

Web Services and Contemporary SOA – 1: Message exchange patterns; Service activity; Coordination; Atomic Transactions; Business activities; Orchestration; Choreography

UNIT 4**7 Hours**

Web Services and Contemporary SOA – 2: Addressing; Reliable messaging; Correlation; Policies; Metadata exchange; Security; Notification and eventing

PART – B**UNIT 5****7 Hours**

Principles of Service – Orientation: Services-orientation and the enterprise; Anatomy of a service-oriented architecture; Common Principles of Service-orientation; How service orientation principles inter-relate; Service-orientation and object-orientation; Native Web service support for service-orientation principles.

UNIT 6**6 Hours**

Service Layers: Service-orientation and contemporary SOA; Service layer abstraction; Application service layer, Business service layer, Orchestration service layer; Agnostic services; Service layer configuration scenarios

UNIT 7**7 Hours**

Business Process Design: WS-BPEL language basics; WS-Coordination overview; Service-oriented business process design; WS-addressing language basics; WS-Reliable Messaging language basics

UNIT 8**6 Hours**

SOA Platforms: SOA platform basics; SOA support in J2EE; SOA support in .NET; Integration considerations

Text Books:

1. Thomas Erl: Service-Oriented Architecture – Concepts, Technology, and Design, Pearson Education, 2005.

Reference Books:

1. Eric Newcomer, Greg Lomow: Understanding SOA with Web Services, Pearson Education, 2005.

Clouds, Grids, and Clusters

Subject Code: 10CS845

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT - 1 6 Hours

Introduction: Overview of Cloud Computing, Applications, Intranets and the Cloud, When can cloud Computing be used? Benefits and limitations, Security concerns, Regulatory issues

UNIT - 2 6 Hours

Business Case for Cloud, Examples of Cloud Services: Cloud computing services, Help to the business, Deleting the data center. Examples: Google, Microsoft, IBM, Salesforce.com and its uses, Cloud at Thomson Reuters.

UNIT - 3 7 Hours

Technology, Cloud Storage, Standards: Cloud Computing Technology: Clients, Security, Network, Services.
Overview of Cloud storage, Some providers of Cloud storage. Standards: Applications, Clients, Infrastructure, Service.

UNIT - 4 7 Hours

Other issues: Overview of SaaS (Software as a Service), Driving forces, Company offerings: Google, Microsoft, IBM. Software plus Service: Overview, Mobile device integration Local Clouds, Thin Clients, Migrating to the Cloud: Virtualization, Server solutions, Thin clients, Cloud services for individuals, mid-markets, and enterprises, Migration.

PART - B

UNIT - 5 7 Hours

GRID Computing – 1: Introduction: Data Center, The Grid and the Distributed/ High Performance Computing, Cluster Computing and Grid Computing, Metacomputing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web services and Grid Computing, Business Computing and the Grid – a Potential Win win Situation, e-Governance and the Grid. Technologies and Architectures for Grid Computing: Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids. OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF (Web

Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

The Grid and the Database: Issues in Database Integration with the Grid, The Requirements of a Grid enabled database, Storage Request Broker (SRB), How to integrate the Database with the Grid? The Architecture of OGSA- DAI for Offering Grid Database Services

UNIT - 6

6 Hours

GRID Computing – 2: World Wide Grid Computing Activites, Organizations and Projects: Standards Organizations, Organizations Developing Grid Computing Tool Kits, Framework and Middleware, Grid Projects and Organizations Building and Using Grid Based Solutions. Web Services and the Service Oriented Architecture (SOA): History and Background, Service Oriented Architecture, How a Web Service Works, SOAP and WSDL, Description, Creating Web Services, Server Side. Globus Toolkit: History of Globus Toolkit, Versions of Globus Toolkit, Applications of GT4 – cases, GT4 – Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data, Choreography and Coordination, Main Features of GT4 Functionality – a Summary, GT4 Architecture, GT4 Command Line Programs, GT4 Containers.

UNIT - 7

7 Hours

Cluster Computing – 1: Introduction: What is Cluster Computing, Approaches to Parallel Computing, How to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster, What is the Functionality a Cluster can offer? Categories of Clusters Cluster Middleware: Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools. Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures, High Throughput Computing Clusters, Condor. Setting up and Administering a Cluster: How to set up a Simple Cluster? Design considerations for the Front End of a Cluster, Setting up nodes, Clusters of Clusters or Metaclusters, System Monitoring, Directory Services inside the Clusters & DCE, Global Clocks Sync, Administering heterogeneous Clusters.

UNIT - 8

6 Hours

Cluster Computing – 2: Cluster Technology for High Availability: Highly Available Clusters, High Availability Parallel Computing, Mission Critical (or Business Critical or Business Continuity) Applications, Types of Failures and Errors, Cluster Architectures and Configurations for High Availability, Faults and Error Detection, Failure Recovery, Failover / Recovery Clusters. Performance Model and Simulation: Performance Measures and Metrics, Profit Effectiveness of Parallel Computing through Clusters. Process Scheduling, Load Sharing and Load Balancing: Job Management System

(JMS) Resource Management System (RMS), Queues, Hosts, Resources, Jobs and Policies, Policies for Resource Utilization, Scheduling Policies Load Sharing and Load Balancing, Strategies for Load Balancing, Modeling Parameters Case Studies of Cluster Systems: Beowulf, PARAM.

Text Books:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Hill, 2010.
2. Prabhu: Grid and Cluster Computing, PHI, 2008.

Reference Books:

1. Joshy Joseph, Craig Fellenstein: Grid Computing, Pearson Education, 2007.
2. Internet Resources

MULTI-CORE ARCHITECTURE AND PROGRAMMING

Subject Code: 10CS846

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT 1

7 Hours

Introduction

The power and potential of parallelism, Examining sequential and parallel programs, Parallelism using multiple instruction streams, The Goals: Scalability and performance portability, Balancing machine specifics with portability, A look at six parallel computers: Chip multiprocessors, Symmetric multiprocessor architectures, Heterogeneous chip designs, Clusters, Supercomputers, Observations from the six parallel computers.

UNIT 2

6 Hours

Reasoning about Performance

Motivation and basic concepts, Sources of performance loss, Parallel structure, Performance trade-offs, Measuring performance, Scalable performance.

UNIT 3

6 Hours

Examples of Multi-Core Architectures

Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller; Intel Core i7: Architecture, The Intel Core i7 Processor, Intel QuickPath Interconnect, The SCH; Intel Atom Architecture.

Introduction to Texas Instruments' Multi-Core Multilayer SoC architecture for communications, infrastructure equipment

UNIT 4

7 Hours

Parallel Algorithm Design

Introduction, The Task / Channel model, Foster's design methodology, Examples: Boundary value problem, Finding the maximum, The n-Body problem, Adding data input.

PART – B

UNIT 5

7 Hours

Parallel Programming – 1 (Using OpenMP)

Designing for threads: Task decomposition, Data decomposition, Data flow decomposition, Implications of different decompositions; Challenges in decomposition, Parallel programming patterns, A motivating problem: Error diffusion.

Threading and Parallel Programming Constructs: Synchronization, Critical sections, Deadlocks, Synchronization primitives: Semaphores, Locks, Condition variables; Messages, Flow Control-Based concepts: Fence, Barrier; Implementation-Dependent threading issues.

UNIT 6

6 Hours

Parallel Programming – 2 (Using OpenMP)

Introduction, The shared-memory model, Parallel *for* loops, Declaring private variables, Critical sections, Reductions, Performance improvements, More general data parallelism, Functional parallelism.

UNIT 7

7 Hours

Solutions to Common Parallel Programming Problems

Too many threads, Data races, deadlocks, and live locks, Heavily contended locks, Non-blocking algorithms, Thread-safe functions and libraries, Memory issues, Cache-related issues, Avoiding pipeline stalls, Data organization for high performance.

UNIT 8

6 Hours

Threading in the Processor

Single-Core Processors: Processor architecture fundamentals, Comparing Superscalar and EPIC architectures.

Multi-Core Processors: Hardware-based threading, Hyper-threading technology, Multi-Core processors, Multiple processor interactions, Power consumption, Beyond multi-core architecture.

NOTE: In order to acquire a sound understanding of the subject, it is desirable for the students to work in the laboratory using OpenMP. The

hands-on experience would reinforce the concepts learnt in theory. Problems similar to the ones solved in the Algorithms Laboratory can be solved and issues like speed-up achieved can be analyzed in depth. Several free tools are available from companies like INTEL to facilitate such a study.

Text Books:

1. Calvin Lin, Lawrence Snyder: Principles of Parallel Programming, Pearson Education, 2009.
(Listed topics only from Chapters 1, 2, 3)
2. Michael J. Quinn: Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2004.
(Listed topics only from Chapters 3, 17)
3. Shameem Akhter, Jason Roberts: Multi-Core Programming, Increasing Performance through Software Multithreading, Intel Press, 2006.
(Listed topics only from Chapters 3, 4, 7, 9, 10)
4. Web resources for Example Architectures of INTEL and Texas Instruments:
<http://download.intel.com/design/intarch/papers/321087.pdf> ;
<http://focus.ti.com/lit/wp/spry133/spry133.pdf>

Reference Books:

1. Introduction to Parallel Computing – Ananth Grama et. al., Pearson Education, 2009.
2. Reinders : Intel Threading Building Blocks, O'reilly –2005
3. David Culler et. al.: Parallel Computer Architecture: A Hardware/Software Approach, Elsevier, 2006.
4. Richard Gerber, Aart J.C. Bik, Kevin B. Smith, Xinmin Tian: Software Optimization Cookbook, High-Performance Recipes for IA-32 Platforms, 2nd Edition, Intel Press, 2006.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT31	Engineering Mathematics - III	04	--	03	80	20	100	4
2	15CS32	Analog and Digital Electronics	04	--	03	80	20	100	4
3	15CS33	Data Structures and Applications	04	--	03	80	20	100	4
4	15CS34	Computer Organization	04	--	03	80	20	100	4
5	15CS35	Unix and Shell Programming	04	--	03	80	20	100	4
6	15CS36	Discrete Mathematical Structures	04	--	03	80	20	100	4
7	15CSL37	Analog and Digital Electronics Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL38	Data Structures Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT41	Engineering Mathematics - IV	04	--	03	80	20	100	4
2	15CS 42	Software Engineering	04	--	03	80	20	100	4
3	15CS43	Design and Analysis of Algorithms	04	--	03	80	20	100	4
4	15CS 44	Microprocessors and Microcontrollers	04	--	03	80	20	100	4
5	15CS45	Object Oriented Concepts	04	--	03	80	20	100	4
6	15CS46	Data Communication	04	--	03	80	20	100	4
7	15CSL47	Design and Analysis of Algorithm Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL48	Microprocessors Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS51	Management and Entrepreneurship for IT Industry	04	--	03	80	20	100	4
2	15CS52	Computer Networks	04	--	03	80	20	100	4
3	15CS53	Database Management System	04	--	03	80	20	100	4
4	15CS54	Automata theory and Computability	04	--	03	80	20	100	4
5	15CS55x	Professional Elective 1	03	--	03	80	20	100	3
6	15CS56x	Open Elective 1	03	--	03	80	20	100	3
7	15CSL57	Computer Network Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL58	DBMS Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 1		Open Elective	
15CS553	Advanced JAVA and J2EE	15CS564	Dot Net framework for application development;

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. Computer Science & Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS61	Cryptography, Network Security and Cyber Law	04	--	03	80	20	100	4
2	15CS62	Computer Graphics and Visualization	04	--	03	80	20	100	4
3	15CS63	System Software and Compiler Design	04	--	03	80	20	100	4
4	15CS64	Operating Systems	04	--	03	80	20	100	4
5	15CS65x	Professional Elective 2	03	--	03	80	20	100	3
6	15CS66x	Open Elective 2	03	--	03	80	20	100	3
7	15CSL67	System Software and Operating System Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL68	Computer Graphics Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 2		Open elective	
15CS651	Data Mining and Data Warehousing	15CS664	Python Application Programming

- 1. Professional Elective: Electives relevant to chosen specialization / branch**
- 2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks		Total Marks
1	15CS71	Web Technology and its applications	04	--	03	20	80	100	4
2	15CS72	Advanced Computer Architectures	04	--	03	20	80	100	4
3	15CS73	Machine Learning	04	--	03	20	80	100	4
4	15CS74x	Professional Elective 3	03	--	03	20	80	100	3
5	15CS75x	Professional Elective 4	03	--	03	20	80	100	3
6	15CSL76	Machine Learning Laboratory	--	1I+2P	03	20	80	100	2
7	15CSL77	Web Technology Laboratory with mini project	--	1I+2P	03	20	80	100	2
8	15CSP78	Project Phase 1 + Seminar	--	--	--	100	--	100	2
TOTAL			18	6	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CS742	Cloud Computing and its Applications	15CS754	Storage Area Networks

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Project Phase 1 + Seminar : Literature Survey, Problem Identification, Objectives and Methodology, Submission of Synopsis and Seminar

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering
 VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS81	Internet of Things and Applications	4	--	3	20	80	100	4
2	15CS82	Big Data Analytics	4	--	3	20	80	100	4
3	15CS83x	Professional Elective 5	3	--	3	20	80	100	3
4	15CS84	Internship / Professional Practice	Industry Oriented		3	50	50	100	2
5	15CSP85	Project work phase II	--	6	3	100	100	200	5
6	15CSS86	Seminar	--	4	--	100	--	100	2
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CS834	System Modeling and Simulation

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Internship / Professional Practice: To be carried out between 6th and 7th semester vacation or 7th and 8th semester vacation period

ENGINEERING MATHEMATICS-III

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Comprehend and use of analytical and numerical methods in different engineering fields • Apprehend and apply Fourier Series • Realize and use of Fourier transforms and Z-Transforms • Use of statistical methods in curve fitting applications • Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation 			
Module -1			Teaching Hours
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of Periodic functions with period 2π and with arbitrary period $2c$, Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis. Complex Fourier series</p>			10Hours
Module -2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse transform. Z-transform: Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.</p>			10 Hours
Module – 3			
<p>Statistical Methods: Correlation and rank Correlation coefficients, Regression and Regression coefficients, lines of regression - problems Curve fitting: Curve fitting by the method of least squares, Fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}, y = ax^b$. Numerical Methods: Numerical solution of algebraic and transcendental equations by: Regular-falsi method, Secant method, Newton - Raphson method and Graphical method.</p>			10 Hours
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula. Central Difference-Stirling's and Bessel's formulae (all formulae without proof)-Problems. Numerical integration: Simpson's 1/3, 3/8 rule, Weddle's rule (without proof) -Problems</p>			10 Hours

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem (without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, minimal surface of revolution, hanging chain, problems</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> • Use of periodic signals and Fourier series to analyze circuits • Explain the general linear system theory for continuous-time signals and systems using the Fourier Transform • Analyze discrete-time systems using convolution and the z-transform • Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral • Use curl and divergence of a vector function in three dimensions, as well as apply the Green's Theorem, Divergence Theorem and Stokes' theorem in various applications • Solve the simple problem of the calculus of variations 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 4. Conduct Investigations of Complex Problems 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013. 2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 	
Reference Books:	
<ol style="list-style-type: none"> 1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley. 3. H. K Dass and Er. Rajnish Verma ,"Higher Engineering Mathematics", S. Chand, 1st ed. 	

ANALOG AND DIGITAL ELECTRONICS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable the students to			
<ul style="list-style-type: none">• Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT• Evolve and Analyze Operational Amplifier circuits and their applications• Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.• Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.• Describe, Design and Analyze Synchronous and Asynchronous Sequential• Explain and design registers and Counters, A/D and D/A converters.			
Module -1			Teaching Hours
Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter. Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)			10 Hours
Module -2			
The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models. Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.			10 Hours
Module – 3			

<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>	10 Hours
Module-4	
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>	10 Hours
Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
Course outcomes: After Studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions(partly) 3. Modern Tool Usage 4. Problem Analysis 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

DATA STRUCTURES AND APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Illustrate linear representation of data structures: Stack, Queues, Lists • Illustrate linear representation of data structures: Trees, Graphs • Demonstrate sorting and searching algorithms • Find suitable data structure during application development/Problem Solving 			
Module -1			Teaching Hours
<p>Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4</p>			10 Hours
Module -2			
<p>Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13</p>			10 Hours
Module – 3			

<p>Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples</p> <p>Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10</p>	10 Hours
Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7 Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Use different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Use stack, Queue, Lists, Trees and Graphs in problem solving • Implement all data structures in a high-level language for problem solving. 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions 3. Conduct Investigations of Complex Problems 4. Problem Analysis for suitability of data structures. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	

Text Books:

1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014
2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014

Reference Books:

1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning, 2014
2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012
3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013
4. Data Structures using C - A M Tenenbaum, PHI, 1989
5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students to

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.
- Describe memory hierarchy and concept of virtual memory.
- Describe arithmetic and logical operations with integer and floating-point operands.
- Illustrate organization of a simple processor, pipelined processor and other computing systems.

Module -1	Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions	10Hours
Module -2	
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.	10 Hours
Module – 3	
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.	10 Hours
Module-4	
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.	10 Hours
Module-5	

<p>Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.</p>	<p>10 Hours</p>
<p>Course outcomes: After studying this course, students will be able to:</p>	
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Design and analyse simple arithmetic and logical units. 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12) 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 	

UNIX AND SHELL PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Illustrate the UNIX system architecture and use of basic Commands. • Use of editors and networking commands. • Demonstrate writing shell scripts. • Categorize, compare and make use of UNIX system calls. 			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			10Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			10Hours

Module – 3	
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>	10Hours
Module-4	
<p>Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.</p> <p>Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2</p>	10Hours
Module-5	
<p>Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.</p> <p>Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.</p> <p>Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1</p>	10Hours
Course outcomes:	

After studying this course, students will be able to:

- Explain UNIX system and use different commands.
- Write Shell scripts for certain functions on different subsystems.
- Demonstrate use of editors and Perl script writing

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Environment and Sustainability
3. Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition , Wiley,2014.

DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Provide theoretical foundations of computer science to perceive other courses in the programme. • Illustrate applications of discrete structures: logic, relations, functions, set theory and counting. • Describe different mathematical proof techniques, • Illustrate the use of graph theory in computer science. 			
Module -1			Teaching Hours
<p>Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,</p>			10Hours
Module -2			
<p>Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.</p>			10 Hours
Module – 3			
<p>Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.</p>			10 Hours
Module-4			
<p>The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,</p>			10 Hours
Module-5			
<p>Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes</p>			10 Hours

<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Application of different mathematical proofs techniques in proving theorems in the courses. • Compare graphs, trees and their applications.
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Conduct Investigations of Complex Problems 4. Design/Development of Solutions.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007. 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010. 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004. 5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER - III

Laboratory Code	15CSL37	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enable students to get practical experience in design, assembly and evaluation/testing of

- Analog components and circuits including Operational Amplifier, Timer, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and registers using flip-flops.
- Synchronous and Asynchronous sequential circuits.
- A/D and D/A converters

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 20 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

Continued:

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

Study experiment

12. To study 4-bit ALU using IC-74181.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
- Design and demonstrate various combinational logic circuits.
- Design and demonstrate various types of counters and Registers using Flip-flops
- Use simulation package to design circuits.
- Understand the working and implementation of ALU.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Modern Tool Usage

Conduction of Practical Examination:

1. All laboratory experiments (1 to 11 nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script.
4. Marks distribution:
 - a) For questions having part a only- Procedure + Conduction + Viva: **20 + 50 + 10 = 80 Marks**
 - b) For questions having part a and b
 - Part a- Procedure + Conduction + Viva: **10 + 35 + 05 = 50 Marks**
 - Part b- Procedure + Conduction + Viva: **10 + 15 + 05 = 30 Marks**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

DATA STRUCTURES LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Laboratory Code	15CSL38	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 02

Course objectives:

This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Asymptotic performance of algorithms.
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs
- Sorting and searching algorithms

Descriptions (if any)

Implement all the experiments in C Language under Linux / Windows environment.

Laboratory Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following **Array** operations
 - a. Creating an Array of N Integer Elements
 - b. Display of Array Elements with Suitable Headings
 - c. Inserting an Element (**ELEM**) at a given valid Position (**POS**)
 - d. Deleting an Element at a given valid Position(**POS**)
 - e. Exit.Support the program with functions for each of the above operations.
2. Design, Develop and Implement a Program in C for the following operations on **Strings**
 - a. Read a main String (**STR**), a Pattern String (**PAT**) and a Replace String (**REP**)
 - b. Perform Pattern Matching Operation: Find and Replace all occurrences of **PAT** in **STR** with **REP** if **PAT** exists in **STR**. Report suitable messages in case **PAT** does not exist in **STR**Support the program with functions for each of the above operations. Don't use Built-in functions.
3. Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
 - a. **Push** an Element on to Stack
 - b. **Pop** an Element from Stack
 - c. Demonstrate how Stack can be used to check **Palindrome**
 - d. Demonstrate **Overflow** and **Underflow** situations on Stack
 - e. Display the status of Stack

f. Exit

Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(**Remainder**), ^(Power) and **alphanumeric** operands.
5. Design, Develop and Implement a Program in C for the following Stack Applications
 - a. Evaluation of **Suffix expression** with single digit operands and operators: +, -, *, /, %, ^
 - b. Solving **Tower of Hanoi** problem with **n** disks
6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
 - a. Insert an Element on to Circular QUEUE
 - b. Delete an Element from Circular QUEUE
 - c. Demonstrate **Overflow** and **Underflow** situations on Circular QUEUE
 - d. Display the status of Circular QUEUE
 - e. Exit

Support the program with appropriate functions for each of the above operations

Continued:

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: **USN, Name, Branch, Sem, PhNo**
 - a. Create a **SLL** of **N** Students Data by using **front insertion**.
 - b. Display the status of **SLL** and count the number of nodes in it
 - c. Perform Insertion / Deletion at End of **SLL**
 - d. Perform Insertion / Deletion at Front of **SLL(Demonstration of stack)**
 - e. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: **SSN, Name, Dept, Designation, Sal, PhNo**
 - a. Create a **DLL** of **N** Employees Data by using **end insertion**.
 - b. Display the status of **DLL** and count the number of nodes in it
 - c. Perform Insertion and Deletion at End of **DLL**
 - d. Perform Insertion and Deletion at Front of **DLL**
 - e. Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - f. Exit

<p>9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) <p>Support the program with appropriate functions for each of the above operations</p> <p>10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers</p> <ol style="list-style-type: none"> Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message Exit <p>11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method <p>12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K → L as $H(K) = K \bmod m$ (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Analyze and Compare various linear and non-linear data structures Code, debug and demonstrate the working nature of different types of data structures and their applications Implement, analyze and evaluate the searching and sorting algorithms Choose the appropriate data structure for solving real world problems
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> Engineering Knowledge Problem Analysis Design/Development of Solutions Modern Tool Usage
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments (TWELVE nos) are to be included for practical examination. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80) Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate, solve and analyze engineering problems. • Apply numerical methods to solve ordinary differential equations. • Apply finite difference method to solve partial differential equations. • Perform complex analysis. • Interpret use of sampling theory. • Apply joint probability distribution and stochastic process. 			
Module 1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Picard’s method, Taylor’s series method, modified Euler’s method, Runge-Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard’s method, Runge-Kutta method of fourth order			10 Hours
Module 2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Picard’s method, Runge-Kutta method and Milne’s method. Special Functions: Bessel’s functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre’s functions - Legendre’s polynomial, Rodrigue’s formula, problems.			10 Hours
Module 3			
Complex Variables: Function of a complex variable, limits, continuity, differentiability,. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem with proof and problems. Transformations: Conformal transformations, discussion of transformations: $w = z + iy$, $w = z^2$, $w = z + (1/z)$ and bilinear transformations.			10 Hours
Module 4			
Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.			10 Hours
Module 5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.			10 Hours

<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use appropriate numerical methods to solve first and second order ordinary differential equations. • Use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction. • State and prove Cauchy's theorem and its consequences including Cauchy's integral formula. • Compute residues and apply the residue theorem to evaluate integrals. • Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods.
<p>Graduate Attributes</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-Long Learning • Conduct Investigations of Complex Problems
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013. 3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

SOFTWARE ENGINEERING			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Outline software engineering principles and activities involved in building large software programs. • Identify ethical and professional issues and explain why they are of concern to software engineers. • Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. • Differentiate system models, use UML diagrams and apply design patterns. • Discuss the distinctions between validation testing and defect testing. • Recognize the importance of software maintenance and describe the intricacies involved in software evolution. • Apply estimation techniques, schedule project activities and compute pricing. • Identify software quality parameters and quantify software using measurements and metrics. • List software quality standards and outline the practices involved. • Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility. 			
Module 1			Teaching Hours
<p>Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.</p> <p>Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities.</p> <p>Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).</p>			12 Hours
Module 2			
<p>System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5).</p> <p>Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-Oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).</p>			11 Hours
Module 3			
<p>Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695).</p> <p>Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).</p>			9 Hours

Module 4	
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)	10 Hours
Module 5	
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “ The SCRUM Primer, Ver 2.0 ”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):	8 Hours
Course Outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Use the techniques, skills, and modern engineering tools necessary for engineering practice • Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Project Management and Finance • Conduct Investigations of Complex Problems • Modern Tool Usage • Ethics 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24) 2. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf 	
Reference Books:	
<ol style="list-style-type: none"> 1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India 	
Web Reference for eBooks on Agile:	
<ol style="list-style-type: none"> 1. http://agilemanifesto.org/ 2. http://www.jamesshore.com/Agile-Book/ 	

DESIGN AND ANALYSIS OF ALGORITHMS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain various computational problem solving techniques. • Apply appropriate method to solve a given problem. • Describe various methods of algorithm analysis. 			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen’s matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim’s Algorithm, Kruskal’s Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall’s Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic			10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education) 	

MICROPROCESSORS AND MICROCONTROLLERS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Make familiar with importance and applications of microprocessors and microcontrollers
- Expose architecture of 8086 microprocessor and ARM processor
- Familiarize instruction set of ARM processor

Module 1	Teaching Hours
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<p>The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.</p> <p>Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7</p>	10 Hours
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Module 2	
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<p>x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.</p> <p>Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2</p>	10 Hours
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Module 3	
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<p>Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255.</p> <p>Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4</p>	10 Hours
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Module 4	
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<p>Microprocessors versus Microcontrollers, ARM Embedded Systems :The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions</p> <p>Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5</p>	10 Hours
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Module 5	
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<p>Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.</p> <p>Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)</p>	10 Hours
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Course Outcomes: After studying this course, students will be able to

- Differentiate between microprocessors and microcontrollers
- Design and develop assembly language code to solve problems
- Gain the knowledge for interfacing various devices to x86 family and ARM processor
- Demonstrate design of interrupt routines for interfacing devices

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.
 There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

OBJECT ORIENTED CONCEPTS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn fundamental features of object oriented language and JAVA • Set up Java JDK environment to create, debug and run simple Java programs. • Create multi-threaded programs and event handling mechanisms. • Introduce event driven Graphical User Interface (GUI) programming using applets and swings. 			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			10 Hours
Module 2			
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			10 Hours
Module 3			
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			10 Hours
Module 4			
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			10 Hours
Module 5			
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting;			10 Hours

Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using Applets and swings. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Programming Knowledge • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30) 	
Reference Book:	
<ol style="list-style-type: none"> 1. Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 	
Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.	

DATA COMMUNICATION			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data. • Explain with the basics of data communication and various types of computer networks; • Illustrate TCP/IP protocol suite and switching criteria. • Demonstrate Medium Access Control protocols for reliable and noisy channels. • Expose wireless and wired LANs along with IP version. 			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP functions of each layer. • Make out the different types of network devices and their functions within a network 			

- Demonstrate the skills of subnetting and routing mechanisms.

Graduate Attributes

1. Engineering Knowledge
2. Design Development of solution(Partly)
3. Modern Tool Usage
4. Problem Analysis

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Design and implement various algorithms in JAVA • Employ various design strategies for problem solving. • Measure and compare the performance of different algorithms. 			
Description			
Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.			
Experiments			
1	A	Create a Java class called <i>Student</i> with the following details as variables within it. <ul style="list-style-type: none"> (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create n <i>Student</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.	
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.	
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.	
3	A	Write a Java program to read two integers a and b . Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.	
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	
4	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.		

5	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.
To generate the data set use random number generator function.
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8.
 - a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
 - b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Learn 80x86 instruction sets and gains the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS51	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the principles of management, organization and entrepreneur. • Discuss on planning, staffing, ERP and their importance • Infer the importance of intellectual property rights and relate the institutional support 			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline 			

their importance in entrepreneurship

- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS52	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstration of application layer protocols • Discuss transport layer services and understand UDP and TCP protocols • Explain routers, IP and Routing Algorithms in network layer • Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard • Illustrate concepts of Multimedia Networking, Security and Network Management 			
Module – 1			Teaching Hours
<p>Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.</p> <p>T1: Chap 2</p>			10 Hours
Module – 2			
<p>Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.</p> <p>T1: Chap 3</p>			10 Hours
Module – 3			
<p>The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,</p>			10 Hours

Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7	
Module – 4	
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	10 Hours
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case studies: : Netflix, You Tube and Kankan. Network Support for Multimedia: Dimensioning Best-Effort Networks, Providing Multiple Classes of Service, Diffserv, Per-Connection Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7: 7.1,7.2,7.5	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Recognize transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard • Describe Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
<ol style="list-style-type: none"> 1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning 	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS53	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Provide a strong foundation in database concepts, technology, and practice. • Practice SQL programming through a variety of database problems. • Demonstrate the use of concurrency and transactions in database • Design and build database applications for real world problems. 			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal			10 Hours

Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6	
Module – 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design and build simple database systems • Develop application to interact with databases. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
Reference Books:	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS54	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce core concepts in Automata and Theory of Computation • Identify different Formal language Classes and their Relationships • Design Grammars and Recognizers for different formal languages • Prove or disprove theorems in automata theory using their properties • Determine the decidability and intractability of Computational problems 			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages,			10 Hours

<p>Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012 6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012. 	

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS551	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the concepts involved in Object-Oriented modelling and their benefits. • Demonstrate concept of use-case model, sequence model and state chart model for a given problem. • Explain the facets of the unified process approach to design and build a Software system. • Translate the requirements into implementation for Object Oriented design. • Choose an appropriate design pattern to facilitate development procedure. 			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours

Module – 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Describe the concepts of object-oriented and basic class modelling. • Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. • Choose and apply a befitting design pattern for the given problem. 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007. 2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013 	

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS552	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Differentiate the various testing techniques. • Analyze the problem and derive suitable test cases. • Apply suitable technique for designing of flow graph. • Explain the need for planning and monitoring a process. 			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the			8 Hours

process, the quality team. T2: Chapter 17, 20.	
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CS553	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Identify the need for advanced Java concepts like Enumerations and Collections
- Construct client-server applications using Java socket API
- Make use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs
- Demonstrate the use of JavaBeans to develop component-based Java software

Module – 1

Teaching Hours

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

8 Hours

Module – 2

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

8 Hours

Module – 3

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder

8 Hours

Text Book 1: Ch 15

Module – 4	
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects Text Book 1: Ch 31 Text Book 2: Ch 11	8 Hours
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS554	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain principles of algorithms analysis approaches • Compare and contrast a number theoretic based strategies. • Describe complex signals and data flow in networks • Apply the computational geometry criteria. 			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each			

module.

Text Books:

1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990
2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL57	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.

- Implement, analyze and evaluate networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 80
Part A: 10+25+5 =40
Part B: 10+25+5 =40
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL58	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, <u>Branch_id</u>, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, <u>Branch_id</u>, <u>Card_No</u>, Date_Out, Due_Date) LIBRARY_BRANCH(<u>Branch_id</u>, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average.

	<ol style="list-style-type: none"> 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database:</p> <p>STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database:</p> <p>EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

	<ol style="list-style-type: none"> 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
Part B: Mini project	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Create, Update and query on the database. • Demonstrate the working of different concepts of DBMS • Implement, analyze and evaluate the project developed for an application. 	
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 30 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 10 + 35 + 5 = 50 Marks b) Part B: Demonstration + Report + Viva voce = 15 + 10 + 05 = 30 Marks 7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS61	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the concepts of Cyber security • Illustrate key management issues and solutions. • Familiarize with Cryptography and very essential algorithms • Introduce cyber Law and ethics to be followed. 			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber			10 Hours

regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Discuss cryptography and its need to various applications • Design and develop simple cryptography algorithms • Understand cyber security and need cyber Law 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015 2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition 3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013 4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning 	

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS62	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain hardware, software and OpenGL Graphics Primitives. • Illustrate interactive computer graphic using the OpenGL. • Design and implementation of algorithms for 2D graphics Primitives and attributes. • Demonstrate Geometric transformations, viewing on both 2D and 3D objects. • Infer the representation of curves, surfaces, Color and Illumination models 			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong			10 Hours

model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3	
Module – 4	
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions. Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14	10 Hours
Module – 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10 Text-2:Chapter 3: 3-1 to 3.11: Input& interaction	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Decide suitable hardware and software for developing graphics packages using OpenGL. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS63	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define System Software such as Assemblers, Loaders, Linkers and Macroprocessors • Familiarize with source file, object file and executable file structures and libraries • Describe the front-end and back-end phases of compiler and their importance to students 			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Utilize lex and yacc tools for implementing different concepts of system software 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS64	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce concepts and terminology used in OS • Explain threading and multithreaded systems • Illustrate process synchronization and concept of Deadlock • Introduce Memory and Virtual memory management, File system and storage techniques 			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			
Secondary Storage Structures, Protection: Mass storage structures; Disk			10 Hours

<p>structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Apply suitable techniques for management of different resources • Use processor, memory, storage and file system commands • Realize the different concepts of OS in platform of usage through case studies 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
<p>Reference Books</p>	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013. 3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS651	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define multi-dimensional data models. • Explain rules related to association, classification and clustering analysis. • Compare and contrast between different classification and clustering algorithms 			
Module – 1			Teaching Hours
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify data mining problems and implement the data warehouse • Write association rules for a given data pattern. • Choose between classification and clustering solution. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS652	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To Learn How to add functionality to designs while minimizing complexity. • What code qualities are required to maintain to keep code flexible? • To Understand the common design patterns. • To explore the appropriate patterns for design problems 			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Be aware of code qualities needed to keep code flexible • Experience core design principles and be able to assess the quality of a design with respect to these principles. • Capable of applying these principles in the design of object oriented systems. • Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. • Be able to select and apply suitable patterns in specific contexts 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS653	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Formulate and solve transportation and assignment problems. • Apply game theory for decision making problems. 			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel’s Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Select and apply optimization techniques for various problems. • Model the given problem as transportation and assignment problem and solve. • Apply game theory for decision support system. 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS654	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain distributed system, their characteristics, challenges and system models. • Describe IPC mechanisms to communicate between distributed objects • Illustrate the operating system support and File Service architecture in a distributed system • Analyze the fundamental concepts, algorithms related to synchronization. 			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern:			
The question paper will have TEN questions.			

There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CSL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use **data input file** where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid **arithmetic expression**. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate **arithmetic expression** involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with **b** preceded by **n a's** using the grammar $a^n b$ (note: input **n** value)
3. Design, develop and implement YACC/C program to construct **Predictive / LL(1) Parsing Table** for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: **abba\$**
4. Design, develop and implement YACC/C program to demonstrate **Shift Reduce Parsing** technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: **id + id * id**.
5. Design, develop and implement a C/Java program to generate the machine code using

Triples for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$

6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the resulting program into a separate file.
b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (C program) file.
7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **20 + 50 + 10 (80)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CSL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes. • Implementation of line drawing and clipping algorithms using OpenGL functions • Design and implementation of algorithms Geometric transformations on both 2D and 3D objects. 			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham's line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic: sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			

Course outcomes: The students should be able to:

- Apply the concepts of computer graphics
- Implement computer graphics applications using OpenGL
- Animate real world problems using OpenGL

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
 - b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M M Raikar, Computer Graphics using OpenGL, Phillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module – 1

Teaching Hours

Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

10 Hours

Module – 2

HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

10 Hours

Module – 3

JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions

10 Hours

Module – 4

PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling

10 Hours

Module – 5

Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.

10 Hours

Course Outcomes: After studying this course, students will be able to

- Adapt HTML and CSS syntax and semantics to build web pages.

- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS72	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe computer architecture. • Measure the performance of architectures in terms of right parameters. • Summarize parallel architecture and the software used for them. 			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder			10 Hours

Buffer, Register Renaming ,Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts of parallel computing and hardware technologies • Compare and contrast the parallel architectures • Illustrate parallel programming concepts 	
<p>Question paper pattern</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013 	

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS73	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module – 1	Teaching Hours
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<p>Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.</p> <p>Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.</p> <p>Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7</p>	10 Hours
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Module – 2	
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<p>Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.</p> <p>Text Book1, Sections: 3.1-3.7</p>	10 Hours
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Module – 3	
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<p>Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.</p> <p>Text book 1, Sections: 4.1 – 4.6</p>	08 Hours
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Module – 4	
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<p>Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm</p> <p>Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12</p>	10 Hours
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Module – 5	
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<p>Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.</p> <p>Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,</p> <p>Reinforcement Learning: Introduction, Learning Task, Q Learning</p> <p>Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3</p>	12 Hours
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Course Outcomes:After studying this course, students will be able to

- Identify the problems for machine learning. And select the either supervised,

unsupervised or reinforcement learning.

- Explain theory of probability and statistics related to machine learning
- Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydm, Introduction to machine learning, second edition, MIT press.

<p style="text-align: center;">NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII</p>			
Subject Code	15CS741	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn the techniques in natural language processing. • Be familiar with the natural language generation. • Be exposed to Text Mining. • Understand the information retrieval techniques 			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours

Module – 5	
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the natural language text. • Generate the natural language. • Do Text mining. • Apply information retrieval techniques. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008. 2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995. 3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000. 	

CLOUD COMPUTING AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS742	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamentals of cloud computing • Illustrate the cloud application programming and aneka platform • Contrast different cloud platforms used in industry 			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V</p>			8 Hours
Module – 2			8 Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			8 Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix</p>			8 Hours

Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Describe the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS743	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Analyze the cryptographic processes. • Summarize the digital security process. • Indicate the location of a security process in the given system 			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley
2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin
Oxford Scholarship Online: December 2013

Reference Books:

1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS744	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamental design of the unix operating system • Familiarize with the systems calls provided in the unix environment • Design and build an application/service over the unix operating system 			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.			8 Hours

Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Ability to understand and reason out the working of Unix Systems • Build an application/service over a Unix system. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. 2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005. 2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987. 3. Unix Internals - Uresh Vahalia, Pearson Education, 2001. 	

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS751	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Familiarize with the basic concept of soft computing and intelligent systems • Compare with various intelligent systems • Analyze the various soft computing techniques 			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:
1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015
Reference Books:
1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 2011

COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS752	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Review image processing techniques for computer vision • Explain shape and region analysis • Illustrate Hough Transform and its applications to detect lines, circles, ellipses • Contrast three-dimensional image analysis techniques, motion analysis and applications of computer vision algorithms 			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining			8 Hours

Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013. 	

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS753	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the fundamental concepts in image processing • Evaluate techniques followed in image enhancements • Illustrate image segmentation and compression algorithms 			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

Reference Books:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS754	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate storage architectures, • Define backup, recovery, disaster recovery, business continuity, and replication • Examine emerging technologies including IP-SAN • Understand logical and physical components of a storage infrastructure • Identify components of managing and monitoring the data center • Define information security and identify different storage virtualization technologies 			
Module – 1			Teaching Hours
Storage System Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning. Text Book-1 Ch1: 1.2 to 1.4, Ch2: 2.1, 2.3 to 2.5, Ch3: 3.1, 3.3 to 3.5, Ch4: 4.1 and 4.2			8 Hours
Module – 2			
Storage Networking Technologies Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization, Object-Based Storage and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage. Text Book-1 Ch5: 5.3, 5.4, 5.6, 5.9 to 5.11, Ch6: 6.1 to 6.3, Ch7: 7.4, 7.5, 7.7 and 7.9 Ch8: 8.1, 8.2 and 8.4			8 Hours
Module – 3			
Backup, Archive and Replication Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and			8 Hours

Migration in a Virtualized Environment.	
Text Book-1 Ch10: 10.5, 10.8, 10.10 to 10.13, Ch11: 11.1, 11.2, 11.4 and 11.8, Ch12: 12.2, 12.3 and 12.5	
Module – 4	
Cloud Computing and Virtualization Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.	8 Hours
Text Book-1 Ch13: 13.1 to 13.8. Text Book-2 Ch9: 9.1 to 9.5 Ch13: 13.1 to 13.3	
Module – 5	
Securing and Managing Storage Infrastructure Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.	8 Hours
Text Book-1 Ch14: 14.1 to 14.5, Ch15: 15.1 to 15.3, 15.5 and 15.6	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL76	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:
NIL
Course outcomes: The students should be able to:
<ol style="list-style-type: none"> 1. Understand the implementation procedures for the machine learning algorithms. 2. Design Java/Python programs for various Learning algorithms. 3. Apply appropriate data sets to the Machine Learning algorithms. 4. Identify and apply Machine Learning algorithms to solve real world problems.
Conduction of Practical Examination:
<ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script • Marks distribution: Procedure + Conduction + Viva: 20 + 50 +10 (80) <p>Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.</p>

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL77	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Design and develop static and dynamic web pages.
2. Familiarize with Client-Side Programming, Server-Side Programming, Active server Pages.
3. Learn Database Connectivity to web applications.

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.

9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
- Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
 - Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.I as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

- In the examination each student picks one question from part A.
- A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
- The team must submit a brief project report (15-20 pages) that must include the following
 - Introduction
 - Requirement Analysis
 - Software Requirement Specification
 - Analysis and Design
 - Implementation
 - Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Have a good understanding of Web Application Terminologies, Internet Tools other web services.
- Learn how to link and publish web sites

Conduction of Practical Examination:

- All laboratory experiments from part A are to be included for practical examination.

2. Mini project has to be evaluated for 30 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: $10 + 35 + 5 = 50$ Marks
 - b) Part B: Demonstration + Report + Viva voce = $15 + 10 + 05 = 30$ Marks

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

INTERNET OF THINGS TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Assess the genesis and impact of IoT applications, architectures in real world. • Illustrate diverse methods of deploying smart objects and connect them to network. • Compare different Application protocols for IoT. • Infer the role of Data Analytics and Security in IoT. • Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry. 			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,			10 Hours

Smart City Security Architecture, Smart City Use-Case Examples.	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. • Appraise the role of IoT protocols for efficient network communication. • Elaborate the need for Data Analytics and Security in IoT. • Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) 2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017 	
Reference Books:	
<ol style="list-style-type: none"> 1. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands -on- Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) 2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224) 	

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand Hadoop Distributed File system and examine MapReduce Programming • Explore Hadoop tools and manage Hadoop with Ambari • Appraise the role of Business intelligence and its applications across industries • Assess core data mining techniques for data analytics • Identify various Text Mining techniques 			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Master the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			

2. Anil Maheshwari, "**Data Analytics**", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180

Reference Books:

- 1) Tom White, "**Hadoop: The Definitive Guide**", 4th Edition, O'Reilly Media,
- 2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "**Professional Hadoop Solutions**", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

**HIGH PERFORMANCE COMPUTING [As
per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CS831	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

Module – 1

Teaching Hours

Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)

10 Hours

Module – 2

High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built

10 Hours

Module – 3

Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques

10 Hours

Module – 4

Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)

10 Hours

Module – 5

Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks

10 Hours

Course outcomes: The students should be able to:

- Illustrate the key factors affecting performance of CSE applications, and
- Make mapping of applications to high-performance computing systems, and

- Apply hardware/software co-design for achieving performance on real-world applications

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

MODERN INTERFACE DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS832	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
<ul style="list-style-type: none"> • Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002. 			

Reference Books:

3. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
4. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – VIII			
Subject Code	15CS833	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To understand the need for interoperable network management. • To learn to the concepts and architecture behind standards based network management. • To understand the concepts and terminology associated with SNMP and TMN • To understand network management as a typical distributed application 			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			8 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			
Module – 3			8 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			
Module – 4			8 Hours
Broadband Access Networks, Broadband Access Technology; HFCT			

<p>Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles</p>	
<p>Module – 5</p>	
<p>Network Management Applications: Configuration Management- Network 8 Hours Provisioning, Inventory Management, Network Topology, Fault Management-Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p>	
<p>1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books:</p>	
<p>1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

SYSTEM MODELLING AND SIMULATION
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	15CS834	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module – 1

Teaching Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software:** Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

10 Hours

Module – 2

Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions.

Queuing Models:Characteristics of queuing systems,Queuing notation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont...,Steady-state behavior of M /G/1 queue, Networks of queues,

10 Hours

Module – 3

Random-Number Generation:Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique.

10 Hours

Module – 4

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.

Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Contd..**

10 Hours

Module – 5

Measures of performance and their estimation,Output analysis for terminating simulations Continued...,Output analysis for steady-state simulations.

Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of

10 Hours

simulation models, Calibration and validation of models, Optimization via Simulation.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the system concept and apply functional modeling method to model the activities of a static system • Describe the behavior of a dynamic system and create an analogous model for a dynamic system; • Simulate the operation of a dynamic system and make improvement according to the simulation results. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007 	

INTERNSHIP / PROFESSIONAL PRACTISE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII

Subject Code	15CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Evaluation of Internship :

**PROJECT WORK PHASE II [As per Choice Based Credit System
(CBCS) scheme] (Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 05

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Conduction of Practical Examination:

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – VIII

Subject Code	15CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 02

Course objectives: This course will enable students to

•

Description:

•

Course outcomes: The students should be able to:

•

Evaluation of seminar:

B.E
Computer Science and Engineering

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING
(Common to CSE & ISE)**

III SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT31	Engineering Mathematics - III	Mathematics	04	-	03	25	100	125
2	10CS32	Electronic Circuits	CSE/ISE	04	-	03	25	100	125
3	10CS33	Logic Design	CSE/ISE	04	-	03	25	100	125
4	10CS34	Discrete Mathematical Structures	CSE/ISE	04	-	03	25	100	125
5	10CS35	Data Structures with C	CSE/ISE	04	-	03	25	100	125
6	10CS36	Object Oriented Programming with C++	CSE/ISE	04	-	03	25	100	125
7	10CSL37	Data Structures with C/C++ Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL38	Electronic Circuits & Logic Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING
(Common to CSE & ISE)**

IV SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10MAT41	Engineering Mathematics - IV	Maths	04	-	03	25	100	125
2	10CS42	Graph Theory and Combinatorics	CSE/ISE	04	-	03	25	100	125
3	10CS43	Design and Analysis of Algorithms	CSE/ISE	04	-	03	25	100	125
4	10CS44	Unix and Shell Programming	CSE/ISE	04	-	03	25	100	125
5	10CS45	Microprocessors	CSE/ISE	04	-	03	25	100	125
6	10CS46	Computer Organization	CSE/ISE	04	-	03	25	100	125
7	10CSL47	Design and Analysis of Algorithms Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL48	Microprocessors Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

V SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10IS51	Software Engineering	CSE/ISE	04	-	03	25	100	125
2	10CS52	Systems Software	CSE/ISE	04	-	03	25	100	125
3	10CS53	Operating Systems	CSE/ISE	04	-	03	25	100	125
4	10CS54	Database Management Systems	CSE/ISE	04	-	03	25	100	125
5	10CS55	Computer Networks - I	CSE/ISE	04	-	03	25	100	125
6	10CS56	Formal Languages and Automata Theory	CSE/ISE	04	-	03	25	100	125
7	10CSL57	Database Applications Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL58	Systems Software & Operating Systems Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VI SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theor y	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10AL61	Management and Entrepreneurship	CSE/ISE/ MBA	04	-	03	25	100	125
2	10CS62	Unix System Programming	CSE/ISE	04	-	03	25	100	125
3	10CS63/ 10IS662	Compiler Design	CSE/ISE	04	-	03	25	100	125
4	10CS64	Computer Networks - II	CSE/ISE	04	-	03	25	100	125
5	10CS65 / 10IS665	Computer Graphics and Visualization	CSE/ISE	04	-	03	25	100	125
6	10CS66x	Elective I (Group-A)	CSE/ISE	04	-	03	25	100	125
7	10CSL67	Computer Graphics and Visualization Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL68	Unix System Programming and Compiler Design Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective I – Group A

10CS661/10IS661

Operations Research

**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Exam	Total
1	10CS71	Object-Oriented Modeling and Design	CSE/ISE	04	-	03	25	100	125
2	10CS72/ 10IS752	Embedded Computing Systems	CSE/ISE	04	-	03	25	100	125
3	10CS73	Programming the Web	CSE/ISE	04	-	03	25	100	125
4	10CS74	Advanced Computer Architectures	CSE/ISE	04	-	03	25	100	125
5	10CS75x	Elective II (Group-B)	CSE/ISE	04	-	03	25	100	125
6	10CS76x	Elective III(Group-C)	CSE/ISE	04	-	03	25	100	125
7	10CSL77	Networks Laboratory	CSE/ISE	-	03	03	25	50	75
8	10CSL78	Web Programming Laboratory	CSE/ISE	-	03	03	25	50	75
Total				24	06	-	200	700	900

Elective II – Group B

Elective III – Group C

10CS753/10IS753	Java and J2EE	10CS766/10IS766	Fuzzy Logic
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**SCHEME OF TEACHING AND EXAMINATION
B.E. COMPUTER SCIENCE AND ENGINEERING**

VIII SEMESTER

S. No.	Subject Code	Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	Marks		
							IA	Exam	Total
1	10IS81	Software Architectures	CSE/ISE	04	-	03	25	100	125
2	10CS82	System Modeling and Simulation	CSE/ISE	04	-	03	25	100	125
3	10CS83x	Elective IV(Group-D)	CSE/ISE	04	-	03	25	100	125
4	10CS84x	Elective V(Group-E)	CSE/ISE	04	-	03	25	100	125
5	10CS85	Project Work	CSE		06	03	100	100	200
6	10CS86	Seminar	CSE	-	-	-	50	-	50
Total				16	06		250	500	750

Elective IV – Group D

10CS832/10IS832 Web 2.0 and Rich Internet Applications

Elective V– Group E

10CS842 Software Testing

ENGINEERING MATHEMATICS III
(Common to CSE & ISE)

Subject Code: 10MAT31
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Fourier Series: Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT - 2

6 Hours

Fourier Transforms: Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT – 3

6 Hours

Partial Differential Equations (P.D.E): Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT - 4

7 Hours

Applications of P.D.E: Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions (Boundary value problems)

PART – B

UNIT – 5

6 Hours

Numerical Methods: Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel iterative method. Definition of eigen values

and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT - 6

7 Hours

Numerical Methods *contd.*: Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule (All formulae / rules without proof)

UNIT - 7

6 Hours

Calculus of Variations: Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT - 8

7 Hours

Difference Equations and Z-transforms: Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition, Khanna Publishers, 2007.
(Chapters: 10, 22.1 to 22.5, 17.1 to 17.5, 18.1 to 18.2, 18.4 to 18.5, 18.7, 28.1 to 28.2, 28.4 to 28.9, 29.1, 29.5, 29.8 to 29.12, 34.1 to 34.5, 30.1 to 30.2, 23.1 to 23.5, 23.7, 23.9 to 23.11, 23.16)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata Mcgraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

ELECTRONIC CIRCUITS
(Common to CSE & ISE)

Subject Code: 10CS32

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT - 1

7 Hours

Transistors, UJTs, and Thyristors: Operating Point, Common-Emitter Configuration, Thermal Runaway, Transistor Switch, Unijunction Transistors, SCR.

UNIT - 2

6 Hours

Field Effect Transistors: Bipolar Junction Transistors versus Field Effect Transistors, Junction Field Effect Transistors, Metal Oxide Field Effect Transistors, Differences between JFETs and MOSFETs, Handling MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices, Insulated Gate Bipolar Transistors (IGBTs)

UNIT - 3

6 Hours

Optoelectronic Devices: Introduction, Photosensors, Photoconductors, Photodiodes, Phototransistors, Light-Emitting Diodes, Liquid Crystal Displays, Cathode Ray Tube Displays, Emerging Display Technologies, Optocouplers

UNIT - 4

7 Hours

Small Signal Analysis of Amplifiers: Amplifier Bandwidth: General Frequency Considerations, Hybrid h-Parameter Model for an Amplifier, Transistor Hybrid Model, Analysis of a Transistor Amplifier using complete h-Parameter Model, Analysis of a Transistor Amplifier Configurations using Simplified h-Parameter Model (CE configuration only), Small-Signal Analysis of FET Amplifiers, Cascading Amplifiers, Darlington Amplifier, Low-Frequency Response of Amplifiers (BJT amplifiers only).

PART - B

UNIT - 5

6 Hours

Large Signal Amplifiers, Feedback Amplifier: Classification and characteristics of Large Signal Amplifiers, Feedback Amplifiers: Classification of Amplifiers, Amplifier with Negative Feedback, Advantages of Negative Feedback, Feedback Topologies, Voltage-Series (Series-Shunt)

Feedback, Voltage-Shunt (Shunt-Shunt) Feedback, Current-Series (Series-Series) Feedback, Current-Shunt (Shunt-Series) Feedback.

UNIT - 6

7 Hours

Sinusoidal Oscillators, Wave-Shaping Circuits: Classification of Oscillators, Conditions for Oscillations: Barkhausen Criterion, Types of Oscillators, Crystal Oscillator, Voltage-Controlled Oscillators, Frequency Stability.

Wave-Shaping Circuits: Basic RC Low-Pass Circuit, RC Low-Pass Circuit as Integrator, Basic RC High-Pass Circuit, RC High-Pass Circuit as Differentiator, Multivibrators, Integrated Circuit (IC) Multivibrators.

UNIT - 7

7 Hours

Linear Power Supplies, Switched mode Power Supplies: Linear Power Supplies: Constituents of a Linear Power Supply, Designing Mains Transformer; Linear IC Voltage Regulators, Regulated Power Supply Parameters.

Switched Mode Power Supplies: Switched Mode Power Supplies, Switching Regulators, Connecting Power Converters in Series, Connecting Power Converters in Parallel

UNIT - 8

6 Hours

Operational Amplifiers: Ideal Opamp versus Practical Opamp, Performance Parameters, Some Applications: Peak Detector Circuit, Absolute Value Circuit, Comparator, Active Filters, Phase Shifters, Instrumentation Amplifier, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter, Sine Wave Oscillators.

Text Book:

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2009.
(4.1, 4.2, 4.7, 4.8, 5.1 to 5.3, 5.5, 5.6, 5.8, 5.9, 5.13, 5.14, 6.1, 6.3, 7.1 to 7.5, 7.10 to 7.14, Listed topics only from 8, 10.1, 11, 12.1, 12.2, 12.3, 12.5, 13.1 to 13.6, 13.9, 13.10, 14.1, 14.2, 14.6, 14.7, 15.1, 15.5 to 15.7. 16.3, 16.4, 17.12 to 17.22)

Reference Books:

1. Jacob Millman, Christos Halkias, Chetan D Parikh: Millman's Integrated Electronics – Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill, 2010.
2. R. D. Sudhaker Samuel: Electronic Circuits, Sanguine-Pearson, 2010.

LOGIC DESIGN
(Common to CSE & ISE)

Subject Code: 10CS33
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART-A

UNIT – 1 **7 Hours**

Digital Principles, Digital Logic: Definitions for Digital Signals, Digital Waveforms, Digital Logic, 7400 TTL Series, TTL Parameters The Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND, Positive and Negative Logic, Introduction to HDL.

UNIT – 2 **6 Hours**

Combinational Logic Circuits

Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard Covers, HDL Implementation Models.

UNIT – 3 **6 Hours**

Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits

UNIT – 4 **7 Hours**

Clocks, Flip-Flops: Clock Waveforms, TTL Clock, Schmitt Trigger, Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, Analysis of Sequential Circuits, HDL Implementation of FLIP-FLOP

PART-B

UNIT – 5 **6 Hours**

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register Implementation in HDL

UNIT – 6 **7 Hours**

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Presettable Counters,

Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL

UNIT – 7

7 Hours

Design of Synchronous and Asynchronous Sequential Circuits: Design of Synchronous Sequential Circuit: Model Selection, State Transition Diagram, State Synthesis Table, Design Equations and Circuit Diagram, Implementation using Read Only Memory, Algorithmic State Machine, State Reduction Technique.

Asynchronous Sequential Circuit: Analysis of Asynchronous Sequential Circuit, Problems with Asynchronous Sequential Circuits, Design of Asynchronous Sequential Circuit, FSM Implementation in HDL

UNIT – 8

6 Hours

D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution

Text Book:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 7th Edition, Tata McGraw Hill, 2010.

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Cengage Learning, 2004.
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007.
5. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

DISCRETE MATHEMATICAL STRUCTURES
(Common to CSE & ISE)

Subject Code: 10CS34
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, A First Word on Probability, Countable and Uncountable Sets

UNIT – 2 **7 Hours**

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference

UNIT – 3 **6 Hours**

Fundamentals of Logic *contd.*: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – 4 **7 Hours**

Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions

PART – B

UNIT – 5 **7 Hours**

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions

UNIT – 6 **7 Hours**

Relations *contd.*: Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions

UNIT – 7 **6 Hours**

Groups: Definitions, Examples, and Elementary Properties, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets, and Lagrange's Theorem.

Coding Theory and Rings: Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices

UNIT – 8

6 Hours

Group Codes: Decoding with Coset Leaders, Hamming Matrices

Rings and Modular Arithmetic: The Ring Structure – Definition and Examples, Ring Properties and Substructures, The Integers Modulo n

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education, 2004.
(Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.
4. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

DATA STRUCTURES WITH C (Common to CSE & ISE)

Subject Code: 10CS35

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

8 Hours

BASIC CONCEPTS: Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement

UNIT - 2

6 Hours

ARRAYS and STRUCTURES: Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays

UNIT - 3**6 Hours**

STACKS AND QUEUES: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4**6 Hours**

LINKED LISTS: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists

PART - B**UNIT - 5****6 Hours**

TREES – 1: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps.

UNIT - 6**6 Hours**

TREES – 2, GRAPHS: Binary Search Trees, Selection Trees, Forests, Representation of Disjoint Sets, Counting Binary Trees, The Graph Abstract Data Type.

UNIT - 7**6 Hours**

PRIORITY QUEUES Single- and Double-Ended Priority Queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps.

UNIT - 8**8 Hours**

EFFICIENT BINARY SEARCH TREES: Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Splay Trees.

Text Book:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
(Chapters 1, 2.1 to 2.6, 3, 4, 5.1 to 5.3, 5.5 to 5.11, 6.1, 9.1 to 9.5, 10)

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009.
3. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.

4. Robert Kruse & Bruce Leung: Data Structures & Program Design in C, Pearson Education, 2007.

**OBJECT ORIENTED PROGRAMMING WITH C++
(Common to CSE & ISE)**

Subject Code: 10CS36
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1

6 Hours

Introduction: Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types

Function Components, argument passing, inline functions, function overloading, recursive functions

UNIT 2

7 Hours

Classes & Objects – I: Class Specification, Class Objects, Scope resolution operator, Access members, Defining member functions, Data hiding, Constructors, Destructors, Parameterized constructors, Static data members, Functions

UNIT 3

7 Hours

Classes & Objects –II: Friend functions, Passing objects as arguments, Returning objects, Arrays of objects, Dynamic objects, Pointers to objects, Copy constructors, Generic functions and classes, Applications

Operator overloading using friend functions such as +, -, pre-increment, post-increment, [] etc., overloading <<, >>.

UNIT 4

6 Hours

Inheritance – I: Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes

PART – B

UNIT 5

6 Hours

Inheritance – II: Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes

UNIT 6**7 Hours**

Virtual functions, Polymorphism: Virtual function, Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

UNIT 7**6 Hours**

I/O System Basics, File I/O: C++ stream classes, Formatted I/O, I/O manipulators, fstream and the File classes, File operations

UNIT 8**7 Hours**

Exception Handling, STL: Exception handling fundamentals, Exception handling options

STL: An overview, containers, vectors, lists, maps.

Text Books:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.

Reference Books:

1. Stanley B.Lippmann, Josee Lajore: C++ Primer, 4th Edition, Pearson Education, 2005.
2. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
3. K R Venugopal, Rajkumar Buyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.

DATA STRUCTURES WITH C/C++ LABORATORY
(Common to CSE & ISE)

Subject Code: 10CSL37**I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

1. Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
2. Design, develop, and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and then to print both the expressions. The expression consists of

single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).

3. Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).
4. Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations:
 - a. Insert
 - b. Delete
 - c. Display
5. Design, develop, and execute a program in C++ based on the following requirements:

An EMPLOYEE class is to contain the following data members and member functions:

Data members: Employee_Number (an integer), Employee_Name (a string of characters), Basic_Salary (an integer), All_Allowances (an integer), IT (an integer), Net_Salary (an integer).

Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.

(All_Allowances = 123% of Basic; Income Tax (IT) = 30% of the gross salary (= basic_Salary _ All_Allowance); Net_Salary = Basic_Salary + All_Allowances – IT)
6. Design, develop, and execute a program in C++ to create a class called STRING and implement the following operations. Display the results after every operation by overloading the operator <<.
 - i. STRING s1 = "VTU"
 - ii. STRING s2 = "BELGAUM"
 - iii. STIRNG s3 = s1 + s2; (Use copy constructor)
7. Design, develop, and execute a program in C++ to create a class called STACK using an array of integers and to implement the following operations by overloading the operators + and - :
 - i. s1=s1 + element; where s1 is an object of the class STACK and element is an integer to be pushed on to top of the stack.
 - ii. s1=s1- ; where s1 is an object of the class STACK and - operator pops off the top element.

Handle the STACK Empty and STACK Full conditions. Also display the contents of the stack after each operation, by overloading the operator <<.

8. Design, develop, and execute a program in C++ to create a class called LIST (linked list) with member functions to insert an element at the front of the list as well as to delete an element from the front of the list. Demonstrate all the functions after creating a list object.
9. Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.
10. Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to the heap. Use the array representation for the heap. Display the array at the end of insertion phase.
11. Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations:
 - i. Create a doubly linked list by adding each node at the front.
 - ii. Insert a new node to the left of the node whose key value is read as an input.
 - iii. Delete the node of a given data if it is found, otherwise display appropriate message.
 - iv. Display the contents of the list.(Note: Only either (a,b and d) or (a, c and d) may be asked in the examination)
12. Design, develop, and execute a program in C++ to create a class called DATE with methods to accept two valid dates in the form dd/mm/yy and to implement the following operations by overloading the operators + and -. After every operation the results are to be displayed by overloading the operator <<.
 - i. $\text{no_of_days} = d1 - d2$; where $d1$ and $d2$ are DATE objects, $d1 \geq d2$ and no_of_days is an integer.
 - ii. $d2 = d1 + \text{no_of_days}$; where $d1$ is a DATE object and no_of_days is an integer.
13. Design, develop, and execute a program in C++ to create a class called OCTAL, which has the characteristics of an octal number.

Implement the following operations by writing an appropriate constructor and an overloaded operator +.

- i. `OCTAL h = x` ; where x is an integer
- ii. `int y = h + k` ; where h is an OCTAL object and k is an integer.

Display the OCTAL result by overloading the operator <<. Also display the values of h and y.

14. Design, develop, and execute a program in C++ to create a class called BIN_TREE that represents a Binary Tree, with member functions to perform inorder, preorder and postorder traversals. Create a BIN_TREE object and demonstrate the traversals.

Note: In the examination each student picks one question from a lot of *all* the 14 questions.

ELECTRONIC CIRCUITS & LOGIC DESIGN LABORATORY (Common to CSE & ISE)

Subject Code: 10CSL38

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks : 50

PART-A

1. a) Design and construct a suitable circuit and demonstrate the working of positive clipper, double-ended clipper and positive clamper using diodes.
b) Demonstrate the working of the above circuits using a simulation package.
2. a) Design and construct a suitable circuit and determine the frequency response, input impedance, output impedance, and bandwidth of a CE amplifier.
b) Design and build the CE amplifier circuit using a simulation package and determine the voltage gain for two different values of supply voltage and for two different values of emitter resistance.
3. a) Design and construct a suitable circuit and determine the drain characteristics and transconductance characteristics of an enhancement-mode MOSFET.
b) Design and build CMOS inverter using a simulation package and verify its truth table.

4. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
5. a) Design and construct a rectangular waveform generator (Op- Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op- Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
6. Design and implement an astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

PART – B

7. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
10. a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify its working.
11. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate its working.

12. Design and construct a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.

Notes:

1. In the examination, each student picks one question from the lot of questions, either from Part-A or from Part-B. About half the students in the batch are to get a question from Part-A while the rest are to get the question from Part-B.
2. Any simulation package like MultiSim / Pspice etc may be used.

IV SEMESTER

ENGINEERING MATHEMATICS IV
(Common to CSE & ISE)

Subject Code: 10MAT41
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **6 Hours**

Numerical Methods: Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams- Bashforth predictor and corrector methods (All formulae without Proof).

UNIT – 2 **7 Hours**

Complex Variables: Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition
Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT – 3 **6 Hours**

Complex Integration: Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only)

UNIT – 4 **7 Hours**

Series solution of Ordinary Differential Equations and Special Functions:

Series solution – Frobenius method, Series solution of Bessel's

D.E. leading to Bessel function of first kind. Equations reducible to Bessel's

D.E., Series solution of Legendre's D.E. leading to Legendre Polynomials.

Rodrigue's formula

PART – B

UNIT - 5

6 Hours

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$,
 $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule,
Baye's theorem.

UNIT – 6

7 Hours

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson,
Normal and Exponential distributions.

UNIT - 7

7 Hours

Sampling, Sampling distribution, Standard error. Testing of hypothesis for
means. Confidence limits for means, Student's t distribution, Chi-square
distribution as a test of goodness of fit.

UNIT - 8

6 Hours

Concept of joint probability – Joint probability distribution, Discrete and
Independent random variables, Expectation, Covariance, Correlation
coefficient

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic
matrices. Markov chains, Higher transition probabilities. Stationary
distribution of regular Markov chains and absorbing states

Text Book:

1. B.S. Grewal: Higher Engineering Mathematics, 40th Edition,
Khanna Publishers, 2007
(Chapters: 31.1, 31.3 to 31.5, 31.7 to 31.8, 20.1 to 20.20.10, 20.12 to
20.14, 20.16 to 20.19, 16.1 to 16.6, 16.10, 16.13 to 16.14, 24.4 to
24.6, 25.12 to 25.14, 26.1 to 26.6, 26.7 to 26.10, 26.14 to 26.16,
27.1 to 27.6, 27.14, 27.17 to 27.18)
2. Seymour Lipschutz: Probability, Schaum's series.
(Chapters: 5 & 7)

Reference Books:

1. B.V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill, 2006.
2. Glyn James: Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2003.

**GRAPH THEORY AND COMBINATORICS
(Common to CSE & ISE)****Subject Code: 10CS42****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT - 1****7 Hours**

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits

UNIT – 2**6 Hours**

Introduction to Graph Theory *contd.*: Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials

UNIT - 3**6 Hours**

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes

UNIT - 4**7 Hours**

Optimization and Matching: Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory

PART – B**UNIT - 5****6 Hours**

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers

UNIT - 6**6 Hours**

The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials

UNIT - 7**7 Hours**

Generating Functions: Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator

UNIT - 8**7 Hours**

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
(Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

1. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005.
2. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
3. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.
4. Geir Agnarsson & Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

**DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE & ISE)**

Subject Code: 10CS43**I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****7 Hours**

INTRODUCTION: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms
Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

UNIT - 2**6 Hours**

DIVIDE AND CONQUER: Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort and its performance.

UNIT - 3

7 Hours

THE GREEDY METHOD: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

UNIT - 4

6 Hours

DYNAMIC PROGRAMMING: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

PART – B

UNIT - 5

7 Hours

DECREASE-AND-CONQUER APPROACHES, SPACE-TIME TRADEOFFS: Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting
Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

UNIT – 6

7 Hours

LIMITATIONS OF ALGORITHMIC POWER AND COPING WITH THEM: Lower-Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.

UNIT - 7

6 Hours

COPING WITH LIMITATIONS OF ALGORITHMIC POWER:
Backtracking: n - Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem.
Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.
Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem, Knapsack Problem

UNIT – 8

6 Hours

PRAM ALGORITHMS: Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems,

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
(Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
(Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai: Introduction to the Design and Analysis of Algorithms A Strategic Approach, Tata McGraw Hill, 2005.

UNIX AND SHELL PROGRAMMING
(Common to CSE & ISE)

Subject Code: 10CS44	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART – A

UNIT – 1 The Unix Operating System, The UNIX architecture and Command Usage, The File System	6 Hours
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UNIT - 2 Basic File Attributes, the vi Editor	6 Hours
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UNIT – 3 The Shell, The Process, Customizing the environment	7 Hours
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UNIT - 4 More file attributes, Simple filters	7 Hours
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PART – B

UNIT – 5 Filters using regular expressions,	6 Hours
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UNIT – 6 Essential Shell Programming	6 Hours
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UNIT - 7 **7 Hours**
awk – An Advanced Filter

UNIT - 8 **7 Hours**
perl - The Master Manipulator

Text Book:

1. Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.
(Chapters 1.2, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 19)

Reference Books:

1. Behrouz A. Forouzan and Richard F. Gilberg: UNIX and Shell Programming, Cengage Learning, 2005.
2. M.G. Venkateshmurthy: UNIX & Shell Programming, Pearson Education, 2005.

MICROPROCESSORS
(Common to CSE & ISE)

Subject Code: 10CS45

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART A

UNIT – I **7 Hours**

Introduction, Microprocessor Architecture – 1: A Historical Background, The Microprocessor-Based Personal Computer Systems.

The Microprocessor and its Architecture: Internal Microprocessor Architecture, Real Mode Memory Addressing.

UNIT – 2 **7 Hours**

Microprocessor Architecture – 2, Addressing Modes: Introduction to Protected Mode Memory Addressing, Memory Paging, Flat Mode Memory Addressing Modes: Data Addressing Modes, Program Memory Addressing Modes, Stack Memory Addressing Modes

UNIT – 3 **6 Hours**

Programming – 1: Data Movement Instructions: MOV Revisited, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Segment Override Prefix, Assembler Details.

Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division.

UNIT - 4

6 Hours

Programming – 2: Arithmetic and Logic Instructions (continued): BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons.

Program Control Instructions: The Jump Group, Controlling the Flow of the Program, Procedures, Introduction to Interrupts, Machine Control and Miscellaneous Instructions.

PART B

UNIT - 5

6 Hours

Programming – 3: Combining Assembly Language with C/C++: Using Assembly Language with C/C++ for 16-Bit DOS Applications and 32-Bit Applications

Modular Programming, Using the Keyboard and Video Display, Data Conversions, Example Programs

UNIT - 6

7 Hours

Hardware Specifications, Memory Interface – 1: Pin-Outs and the Pin Functions, Clock Generator, Bus Buffering and Latching, Bus Timings, Ready and Wait State, Minimum versus Maximum Mode.

Memory Interfacing: Memory Devices

UNIT – 7

6 Hours

Memory Interface – 2, I/O Interface – 1: Memory Interfacing (continued): Address Decoding, 8088 Memory Interface, 8086 Memory Interface.

Basic I/O Interface: Introduction to I/O Interface, I/O Port Address Decoding.

UNIT 8

7 Hours

I/O Interface – 2, Interrupts, and DMA: I/O Interface (continued): The Programmable Peripheral Interface 82C55, Programmable Interval Timer 8254.

Interrupts: Basic Interrupt Processing, Hardware Interrupts: INTR and INTA/; Direct Memory Access: Basic DMA Operation and Definition.

Text Book:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.
(Listed topics only from the Chapters 1 to 13)

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.

2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. James L. Antonakos: The Intel Microprocessor Family: Hardware and Software Principles and Applications, Cengage Learning, 2007.

COMPUTER ORGANIZATION (Common to CSE & ISE)

Subject Code: 10CS46
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT - 1 6 Hours

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing,

UNIT - 2 7 Hours

Machine Instructions and Programs *contd.*: Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

UNIT - 3 6 Hours

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses

UNIT - 4 7 Hours

Input/Output Organization *contd.*: Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

PART – B

UNIT - 5 7 Hours

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage

UNIT - 6**7 Hours**

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations

UNIT - 7**6 Hours**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control

UNIT - 8**6 Hours**

Multicores, Multiprocessors, and Clusters: Performance, The Power Wall, The Switch from Uniprocessors to Multiprocessors, Amdahl's Law, Shared Memory Multiprocessors, Clusters and other Message Passing Multiprocessors, Hardware Multithreading, SISD, IMD, SIMD, SPMD, and Vector.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
(Listed topics only from Chapters 1, 2, 4, 5, 6, 7)
2. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
(Listed topics only)

Reference Books:

1. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
2. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
(Common to CSE & ISE)**Subject Code: 10CSL47****I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50**

Design, develop and implement the specified algorithms for the following problems using C/C++ Language in LINUX / Windows environment.

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n .
The elements can be read from a file or can be generated using the random number generator.
2. Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.
3.
 - a. Obtain the Topological ordering of vertices in a given digraph.
 - b. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7.
 - a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
 - b. Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using OpenMP and determine the speed-up achieved.
12. Implement N Queen's problem using Back Tracking.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

MICROPROCESSORS LABORATORY
(Common to CSE & ISE)

Subject Code : 10CSL48	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

Notes:

- **Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM, TASM etc may be used.**
 - **Program should have suitable comments.**
 - **The board layout and the circuit diagram of the interface are to be provided to the student during the examination.**
1. a) Search a key element in a list of „n“ 16-bit numbers using the Binary search algorithm.
b) Read the status of eight input bits from the Logic Controller Interface and display „FF“ if it is the parity of the input read is even; otherwise display 00.
 2. a) Write two ALP modules stored in two different files; one module is to read a character from the keyboard and the other one is to display a character. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line.
b) Implement a BCD Up-Down Counter on the Logic Controller Interface.

3. a) Sort a given set of „n“ numbers in ascending order using the Bubble Sort algorithm.
 b) Read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display $X*Y$.
4. a) Read an alphanumeric character and display its equivalent ASCII code at the center of the screen.
 b) Display messages FIRE and HELP alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
5. a) Reverse a given string and check whether it is a palindrome or not.
 b) Assume any suitable message of 12 characters length and display it in the rolling fashion on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages. (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
6. a) Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriate messages. Also display the length of the stored strings.
 b) Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times on a 7-segment display interface.
7. a) Read your name from the keyboard and display it at a specified location on the screen after the message “**What is your name?**” You must clear the entire screen before display.
 b) Scan a 8 x 3 keypad for key closure and to store the code of the key pressed in a memory location or display on screen. Also display row and column numbers of the key pressed.
8. a) Compute nCr using recursive procedure. Assume that „n“ and „r“ are non-negative integers.
 b) Drive a Stepper Motor interface to rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).

9. a) Read the current time from the system and display it in the standard format on the screen.
b) Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
10. a) Write a program to simulate a Decimal Up-counter to display 00-99.
b) Generate a Half Rectified Sine wave form using the DAC interface. (The output of the DAC is to be displayed on the CRO).
11. a) Read a pair of input co-ordinates in BCD and move the cursor to the specified location on the screen.
b) Generate a Fully Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. a) Write a program to create a file (input file) and to delete an existing file.
b) Drive an elevator interface in the following way:
 - i. Initially the elevator should be in the ground floor, with all requests in OFF state.
 - ii. When a request is made from a floor, the elevator should move to that floor, wait there for a couple of seconds (approximately), and then come down to ground floor and stop. If some requests occur during going up or coming down they should be ignored.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

SOFTWARE ENGINEERING

Subject Code: 10IS51**I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100**

PART – A

UNIT – 1**6 Hours****Overview:** Introduction: FAQ's about software engineering, Professional and ethical responsibility.

Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT – 2**6 Hours****Critical Systems, Software Processes:** Critical Systems: A simple safety-critical system; System dependability; Availability and reliability.

Software Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT – 3**7 Hours****Requirements:** Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

UNIT – 4**7 Hours****System models, Project Management:** System Models: Context models; Behavioral models; Data models; Object models; Structured methods.

Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5**7 Hours****Software Design:** Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.

Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6

6 Hours

Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development.

Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7

7 Hours

Verification and Validation: Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8

6 Hours

Management: Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.

Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007.
(Chapters:- 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill, 2007.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

SYSTEM SOFTWARE

Subject Code: 10CS52

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples.

UNIT – 2**6 Hours**

Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT – 3**6 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One- Pass Assembler, Multi-Pass Assembler, Implementation Examples - MASM Assembler.

UNIT – 4**8 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

PART – B**UNIT – 5****6 Hours**

Editors and Debugging Systems: Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of The System, User-Interface Criteria

UNIT – 6**8 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators, Implementation Examples - MASM Macro Processor, ANSI C Macro Processor.

UNIT – 7**6 Hours**

Lex and Yacc – 1: Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running

LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line.

UNIT – 8

6 Hours

Lex and Yacc - 2: Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.

Text Books:

1. Leland.L.Beck: System Software, 3rd Edition, Pearson Education, 1997.
(Chapters 1.1 to 1.3, 2 (except 2.5.2 and 2.5.3), 3 (except 3.5.2 and 3.5.3), 4 (except 4.4.3))
2. John.R.Levine, Tony Mason and Doug Brown: Lex and Yacc, O'Reilly, SPD, 1998.
(Chapters 1, 2 (Page 2-42), 3 (Page 51-65))

Reference Books:

1. D.M.Dhamdhare: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999.

OPERATING SYSTEMS

Subject Code: 10CS53

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction to Operating Systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.

UNIT – 2**7 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process communication. Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling; Thread scheduling.

UNIT – 3**7 Hours**

Process Synchronization : Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT – 4**6 Hours**

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

PART – B**UNIT – 5****7 Hours**

Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

UNIT – 6**7 Hours**

File System, Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management

UNIT – 7**6 Hours**

Secondary Storage Structures, Protection : Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

UNIT – 8**6 Hours**

Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.
(Listed topics only from Chapters 1 to 12, 17, 21)

Reference Books:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

DATABASE MANAGEMENT SYSTEMS**Subject Code: 10CS54****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****6 Hours**

Introduction: Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.

Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2**6 Hours**

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3**8 Hours**

Relational Model and Relational Algebra : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update

Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4

6 Hours

SQL – 1: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5

6 Hours

SQL – 2 : Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

UNIT – 6

6 Hours

Database Design – 1: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7

6 Hours

Database Design -2: Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms

UNIT – 8

8 Hours

Transaction Management: The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003. (Chapters 16, 17.1, 17.2, 18)

Reference Books:

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

COMPUTER NETWORKS - I

Subject Code: 10CS55

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT - 1

7 Hours

Introduction: Data Communications, Networks, The Internet, Protocols & Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite, Addressing

UNIT- 2

7 Hours

Physical Layer-1: Analog & Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital-digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog-to-digital conversion (only PCM), Transmission Modes, Digital-to-analog conversion

UNIT- 3

6 Hours

Physical Layer-2 and Switching: Multiplexing, Spread Spectrum, Introduction to switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT- 4

6 Hours

Data Link Layer-1: Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum.

PART - B

UNIT- 5 **6 Hours**

Data Link Layer-2: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy channels, HDLC, PPP (Framing, Transition phases only)

UNIT- 6 **7 Hours**

Multiple Access & Ethernet: Random access, Controlled Access, Channelization, Ethernet: IEEE standards, Standard Ethernet, Changes in the standard, Fast Ethernet, Gigabit Ethernet

UNIT - 7 **6 Hours**

Wireless LANs and Cellular Networks: Introduction, IEEE 802.11, Bluetooth, Connecting devices, Cellular Telephony

UNIT - 8: **7 Hours**

Network Layer: Introduction, Logical addressing, IPv4 addresses, IPv6 addresses, Internetworking basics, IPv4, IPv6, Comparison of IPv4 and IPv6 Headers.

Text Books:

1. Behrouz A. Forouzan,: Data Communication and Networking, 4th Edition Tata McGraw-Hill, 2006.
(Chapters 1.1 to 1.4, 2.1 to 2.5, 3.1 To 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.7, 12.1 to 12.3, 13.1 to 13.5, 14.1, 14.2, 15.1, 16.1, 19.1, 19.2, 20.1 to 20.3)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

FORMAL LANGUAGES AND AUTOMATA THEORY

Subject Code: 10CS56 I.A. Marks : 25
Hours/Week : 04 Exam Hours: 03
Total Hours : 52 Exam Marks: 100

PART - A

UNIT – 1 **7 Hours**
Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2 **7 Hours**
Finite Automata, Regular Expressions: An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3 **6 Hours**
Regular Languages, Properties of Regular Languages: Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4 **6 Hours**
Context-Free Grammars And Languages : Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages .

PART – B

UNIT – 5 **7 Hours**
Pushdown Automata: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG"s; Deterministic Pushdown Automata

UNIT – 6 **6 Hours**
Properties of Context-Free Languages: Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7 **7 Hours**
Introduction To Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines;

Extensions to the basic Turing Machines; Turing Machine and Computers.

UNIT – 8

6 Hours

Undecidability: A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2007.
(Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

1. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3rd Edition, PHI Learning, 2009.
2. Raymond Greenlaw, H. James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.
3. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

DATABASE APPLICATIONS LABORATORY

Subject Code: 10CSL57

I.A. Marks : 25

Hours/Week : 03

Exam Hours: 03

Total Hours : 42

Exam Marks: 50

1. Consider the following relations:

Student (*snum*: integer, *sname*: string, *major*: string, *level*: string, *age*: integer)

Class (*name*: string, *meets at*: string, *room*: string, *d*: integer)

Enrolled (*snum*: integer, *cname*: string)

Faculty (*fid*: integer, *fname*: string, *deptid*: integer)

The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

- i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
- ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
- iii. Find the names of all students who are enrolled in two classes that meet at the same time.
- iv. Find the names of faculty members who teach in every room in which some class is taught.
- v. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

2. The following relations keep track of airline flight information:

Flights (*no*: integer, *from*: string, *to*: string, *distance*: integer,

Departs: time, *arrives*: time, *price*: real)

Aircraft (*aid*: integer, *aname*: string, *cruisingrange*: integer)

Certified (*eid*: integer, *aid*: integer)

Employees (*eid*: integer, *ename*: string, *salary*: integer)

Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.

Write each of the following queries in SQL.

- i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000.
- ii. For each pilot who is certified for more than three aircrafts, find the *eid* and the maximum *cruisingrange* of the aircraft for which she or he is certified.
- iii. Find the names of pilots whose *salary* is less than the price of the cheapest route from Bengaluru to Frankfurt.
- iv. For all aircraft with *cruisingrange* over 1000 Kms, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
- v. Find the names of pilots certified for some Boeing aircraft.
- vi. Find the *aids* of all aircraft that can be used on routes from Bengaluru to New Delhi.

3. Consider the following database of student enrollment in courses & books adopted for each course.

STUDENT (regno: string, name: string, major: string, bdate:date)

COURSE (course #:int, cname:string, dept:string)

ENROLL (regno:string, course#:int, sem:int, marks:int)

BOOK _ ADOPTION (course#:int, sem:int, book-ISBN:int)

TEXT (book-ISBN:int, book-title:string, publisher:string, author:string)

- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Demonstrate how you add a new text book to the database and make this book be adopted by some department.
 - iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the „CS“ department that use more than two books.
 - v. List any department that has *all* its adopted books published by a specific publisher.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
4. The following tables are maintained by a book dealer.
- AUTHOR (author-id:int, name:string, city:string, country:string)
PUBLISHER (publisher-id:int, name:string, city:string, country:string)
CATALOG (book-id:int, title:string, author-id:int, publisher-id:int, category-id:int, year:int, price:int)
CATEGORY (category-id:int, description:string)
ORDER-DETAILS (order-no:int, book-id:int, quantity:int)
- i. Create the above tables by properly specifying the primary keys and the foreign keys.
 - ii. Enter at least five tuples for each relation.
 - iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
 - iv. Find the author of the book which has maximum sales.
 - v. Demonstrate how you increase the price of books published by a specific publisher by 10%.
 - vi. Generate suitable reports.
 - vii. Create suitable front end for querying and displaying the results.
5. Consider the following database for a banking enterprise
- BRANCH(branch-name:string, branch-city:string, assets:real)
ACCOUNT(accno:int, branch-name:string, balance:real)
DEPOSITOR(customer-name:string, accno:int)
CUSTOMER(customer-name:string, customer-street:string, customer-city:string)
LOAN(loan-number:int, branch-name:string, amount:real)
BORROWER(customer-name:string, loan-number:int)

- i. Create the above tables by properly specifying the primary keys and the foreign keys
- ii. Enter at least five tuples for each relation
- iii. Find all the customers who have at least two accounts at the *Main* branch.
- iv. Find all the customers who have an account at *all* the branches located in a specific city.
- v. Demonstrate how you delete all account tuples at every branch located in a specific city.
- vi. Generate suitable reports.
- vii. Create suitable front end for querying and displaying the results.

Instructions:

1. The exercises are to be solved in an RDBMS environment like Oracle or DB2.
2. Suitable tuples have to be entered so that queries are executed correctly.
3. Front end may be created using either VB or VAJ or any other similar tool.
4. The student need not create the front end in the examination. The results of the queries may be displayed directly.
5. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
6. Questions must be asked based on lots.

**SYSTEM SOFTWARE & OPERATING SYSTEMS
LABORATORY**

Subject Code: 10CSL58	I.A. Marks : 25
Hours/Week : 03	Exam Hours: 03
Total Hours : 42	Exam Marks: 50

PART - A

LEX and YACC Programs:

Design, develop, and execute the following programs using LEX:

1. a) Program to count the number of characters, words, spaces and lines in a given input file.

- b) Program to count the numbers of comment lines in a given C program. Also eliminate them and copy the resulting program into separate file.
2.
 - a) Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately.
 - b) Program to recognize whether a given sentence is simple or compound.
3. Program to recognize and count the number of identifiers in a given input file.

Design, develop, and execute the following programs using YACC:

4.
 - a) Program to recognize a valid arithmetic expression that uses operators +, -, * and /.
 - b) Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits.
5.
 - a) Program to evaluate an arithmetic expression involving operators +, -, * and /.
 - b) Program to recognize strings „aaab“, „abbb“, „ab“ and „a“ using the grammar ($a^n b^n, n \geq 0$).
6. Program to recognize the grammar ($a^n b, n \geq 10$).

PART B

UNIX Programming:

Design, develop, and execute the following programs:

7.
 - a) Non-recursive shell script that accepts any number of arguments and prints them in the Reverse order, (For example, if the script is named rargs, then executing rargs A B C should produce C B A on the standard output).
 - b) C program that creates a child process to read commands from the standard input and execute them (a minimal implementation of a shell – like program). You can assume that no arguments will be passed to the commands to be executed.
8.
 - a) Shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions

- are identical, outputs the common permissions, otherwise outputs each file name followed by its permissions.
- b) C program to create a file with 16 bytes of arbitrary data from the beginning and another 16 bytes of arbitrary data from an offset of 48. Display the file contents to demonstrate how the hole in file is handled.
9. a) Shell script that accepts file names specified as arguments and creates a shell script that contains this file as well as the code to recreate these files. Thus if the script generated by your script is executed, it would recreate the original files(This is same as the “bundle” script described by Brain W. Kernighan and Rob Pike in “ The Unix Programming Environment”, Prentice – Hall India).
- b) C program to do the following: Using fork() create a child process. The child process prints its own process-id and id of its parent and then exits. The parent process waits for its child to finish (by executing the wait()) and prints its own process-id and the id of its child process and then exits.

Operating Systems:

10. Design, develop and execute a program in C / C++ to simulate the working of Shortest Remaining Time and Round-Robin Scheduling Algorithms. Experiment with different quantum sizes for the Round-Robin algorithm. In all cases, determine the average turn-around time. The input can be read from key board or from a file.
11. Using OpenMP, Design, develop and run a multi-threaded program to generate and print Fibonacci Series. One thread has to generate the numbers up to the specified limit and another thread has to print them. Ensure proper synchronization.
12. Design, develop and run a program to implement the Banker's Algorithm. Demonstrate its working with different data values.

Instructions:

In the examination, a combination of one LEX and one YACC problem has to be asked from Part A for a total of 30 marks and one programming exercise from Part B has to be asked for a total of 20 marks.

MANAGEMENT AND ENTREPRENEURSHIP
(Common to All Branches)

Subject Code: 10AL61	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

UNIX SYSTEM PROGRAMMING

Subject Code: 10CS62	I.A. Marks : 25
Hours/Week : 04	Exam Hours: 03
Total Hours : 52	Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards.

UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.

UNIT – 2

6 Hours

UNIX Files: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

UNIT – 3

7 Hours

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program.

UNIT – 4

7 Hours

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation,

Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

PART - B

UNIT – 5

7 Hours

Process Control : Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection.

Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.

UNIT – 6

7 Hours

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.1b Timers.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

UNIT – 7

6 Hours

Interprocess Communication – 1: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.

UNIT – 8

6 Hours

Interprocess Communication – 2: Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

Text Books:

1. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999.
(Chapters 1, 5, 6, 7, 8, 9, 10)
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005.
(Chapters 7, 8, 9, 13, 14, 15)

Reference Books:

1. Marc J. Rochkind: Advanced UNIX Programming, 2nd Edition, Pearson Education, 2005.
2. Maurice J Bach: The Design of the UNIX Operating System, Pearson Education, 1987.

3. Uresh Vahalia: UNIX Internals: The New Frontiers, Pearson Education, 2001.

COMPILER DESIGN

Subject Code: 10CS63
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1 **8 Hours**

Introduction, Lexical analysis: Language processors; The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics.

Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

UNIT – 2 **6 Hours**

Syntax Analysis – 1: Introduction; Context-free Grammars; Writing a Grammar. Top-down Parsing; Bottom-up Parsing.

UNIT – 3 **6 Hours**

Syntax Analysis – 2: Top-down Parsing; Bottom-up Parsing.

UNIT – 4 **6 Hours**

Syntax Analysis – 3: Introduction to LR Parsing: Simple LR; More powerful LR parsers (excluding Efficient construction and compaction of parsing tables) ; Using ambiguous grammars; Parser Generators.

PART – B

UNIT – 5 **7 Hours**

Syntax-Directed Translation: Syntax-directed definitions; Evaluation orders for SDDs; Applications of syntax-directed translation; Syntax-directed translation schemes.

UNIT – 6 **6 Hours**

Intermediate Code Generation: Variants of syntax trees; Three-address code; Translation of expressions; Control flow; Back patching; Switch-statements; Procedure calls.

UNIT – 7**6 Hours**

Run-Time Environments : Storage Organization; Stack allocation of space; Access to non-local data on the stack; Heap management; Introduction to garbage collection.

UNIT – 8**7 Hours**

Code Generation: Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Text Books:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.
(Chapters 1, 3.1 to 3.4, 4 excluding 4.7.5 and 4.7.6, 5.1 to 5.4, 6.1, 6.2, 6.4, 6.6, 6.7 to 6.9, 7.1 to 7.5, 8.1 to 8.6.)

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
3. Kenneth C Loudon: Compiler Construction Principles & Practice, Cengage Learning, 1997.

COMPUTER NETWORKS - II**Subject Code: 10CS64****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT - 1****6 Hours**

Packet Switching Networks - 1: Network services and internal network operation, Packet network topology, Routing in Packet networks, Shortest path routing: Bellman-Ford algorithm.

UNIT – 2**6 Hours**

Packet Switching Networks – 2: Shortest path routing (continued), Traffic management at the Packet level, Traffic management at Flow level, Traffic management at flow aggregate level.

UNIT – 3**6 Hours****TCP/IP-1:** TCP/IP architecture, The Internet Protocol, IPv6, UDP.**UNIT – 4****8 Hours****TCP/IP-2:** TCP, Internet Routing Protocols, Multicast Routing, DHCP, NAT and Mobile IP.**PART – B****UNIT - 5****7 Hours****Applications, Network Management, Network Security:** Application layer overview, Domain Name System (DNS), Remote Login Protocols, E-mail, File Transfer and FTP, World Wide Web and HTTP, Network management, Overview of network security, Overview of security methods, Secret-key encryption protocols, Public-key encryption protocols, Authentication, Authentication and digital signature, Firewalls.**UNIT – 6****6 Hours****QoS, VPNs, Tunneling, Overlay Networks:** Overview of QoS, Integrated Services QoS, Differentiated services QoS, Virtual Private Networks, MPLS, Overlay networks.**UNIT - 7****7 Hours****Multimedia Networking:** Overview of data compression, Digital voice and compression, JPEG, MPEG, Limits of compression with loss, Compression methods without loss, Overview of IP Telephony, VoIP signaling protocols, Real-Time Media Transport Protocols, Stream control Transmission Protocol (SCTP)**UNIT – 8****6 Hours****Mobile AdHoc Networks and Wireless Sensor Networks:** Overview of Wireless Ad-Hoc networks, Routing in AdHOc Networks, Routing protocols for and Security of AdHoc networks, Sensor Networks and protocol structures, Communication Energy model, Clustering protocols, Routing protocols, ZigBee technology and 802.15.4.

Text Books:

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia & Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
(7 - excluding 7.6, 8)
2. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
(9, 10 excluding 10.7, 12.1 to 12.3, 16, 17.1 to 17.6, 18.1 to 18.3, 18.5, 19, 20)

Reference Books:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Wayne Tomasi: Introduction to Data Communications and Networking, Pearson Education, 2005.

COMPUTER GRAPHICS AND VISUALIZATION

Subject Code: 10CS65
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A**UNIT – 1****7 Hours**

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics
Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2**6 Hours**

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting Implicit Functions

UNIT – 3**7 Hours**

Input and Interaction: Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4**6 Hours**

Geometric Objects and Transformations-I: Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

PART - B**UNIT – 5****5 Hours**

Geometric Objects and Transformations-II: Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion's.

UNIT – 6**7 Hours**

Viewing: Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7**6 Hours**

Lighting and Shading: Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8**8 Hours**

Implementation: Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.

2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

OPERATIONS RESEARCH

Subject Code: 10CS661
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART - A

UNIT – 1 **6 Hours**

Introduction, Linear Programming – 1: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation .
 Introduction to Linear Programming: Prototype example; The linear programming (LP) model.

UNIT – 2 **7 Hours**

LP – 2, Simplex Method – 1: Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method

UNIT – 3 **6 Hours**

Simplex Method – 2: Adapting to other model forms; Post optimality analysis; Computer implementation
 Foundation of the simplex method.

UNIT – 4 **7 Hours**

Simplex Method – 2, Duality Theory: The revised simplex method, a fundamental insight.
 The essence of duality theory; Economic interpretation of duality, Primal dual relationship; Adapting to other primal forms

PART - B

UNIT – 5 **7 Hours**

Duality Theory and Sensitivity Analysis, Other Algorithms for LP : The role of duality in sensitive analysis; The essence of sensitivity analysis;

Applying sensitivity analysis. The dual simplex method; Parametric linear programming; The upper bound technique.

UNIT – 6

7 Hours

Transportation and Assignment Problems: The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.

UNIT – 7

6 Hours

Game Theory, Decision Analysis: Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions.

Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.

UNIT – 8

6 Hours

Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

Text Books:

1. Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8th Edition, Tata McGraw Hill, 2005. (Chapters: 1, 2, 3.1 to 3.4, 4.1 to 4.8, 5, 6.1 to 6.7, 7.1 to 7.3, 8, 13, 14, 15.1 to 15.4)

Reference Books:

1. Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Cengage Learning, 2003.
2. Hamdy A Taha: Operations Research: An Introduction, 8th Edition, Pearson Education, 2007.

SIGNALS AND SYSTEMS

Subject Code: 10CS662

I.A. Marks : 25

Hours/Week : 04

Exam Hours: 03

Total Hours : 52

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction: Definitions of a signal and a system; Classification of signals; Basic operations on signals; Elementary signals.

UNIT – 2 **7 Hours**
Systems, Time-domain representations – 1: Systems viewed as interconnections of operations; Properties of systems; Convolution; Impulse response representation; Properties of impulse response representation.

UNIT – 3 **6 Hours**
Time domain representation – 2: Differential and difference equation representations; Block diagram representations.

UNIT – 4 **6 Hours**
Fourier Representation – 1: Fourier representation: Introduction; Fourier representations for four signal classes; Orthogonality of complex sinusoidal signals.

PART – B

UNIT – 5 **6 Hours**
Fourier Representation -2: DTFS representations; Continuous-time Fourier-series representations; DTFT and FT representations; Properties of Fourier representations.

UNIT – 6 **7 Hours**
Application of Fourier representations – 1: Frequency response of LTI systems; Solution of differential and difference equations using system function.

UNIT – 7 **7 Hours**
Applications of Fourier Representations – 2, Z-Transforms – 1: Fourier transform representations for periodic signals; Sampling of continuous time signals and signal reconstruction.
Introduction to Z-transform; Properties of ROC; Properties of Z-transforms; Inversion of Z-transforms

UNIT –Z– 8 **6 Hours**
Transforms – 2: Transforms analysis of LTI systems; Transfer function; Stability and causality; Unilateral Z-transforms and its application to solve difference equations

Text Books:

1. Simon Haykin and Barry Van Veen: Signals and Systems, 2nd Edition, Wiley India, 2007.
(Chapters: 1.1 to 1.8, 2.2 to 2.5, 3.1 to 3.6, 4.2 to 4.3, 4.7, 7.1 to 7.6, 7.8)

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab: Signals and Systems, 2nd Edition, PHI, 1997, Indian reprint 2009.
2. Ganesh Rao D and Satish Tunga: Signals and Systems - A Simplified Approach, Sanguine Technical Publishers, 2003-04.

DATA COMPRESSION

Subject Code: 10CS663
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT –1 7 Hours

Introduction, Lossless Compression -1: Compression techniques; Modeling and coding.

Mathematical preliminaries for lossless compression: Overview; Basic concepts of Information Theory; Models; Coding; Algorithmic information theory; Minimum description length principle.

Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression.

UNIT – 2 6 Hours

Lossless Compression – 2: Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42.

Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG-LS; Multiresolution approaches; Facsimile encoding: Run-length coding, T.4 and T.6.

UNIT – 3 6 Hours

Basics of Lossy Coding: Some mathematical concepts: Overview; Introduction; Distortion criteria; Models.

Scalar quantization: Overview; Introduction; The quantization problem; Uniform quantizer; Adaptive quantization.

UNIT – 4 7 Hours

Vector Quantization, Differential Encoding: Vector quantization: Overview; Introduction; Advantages of vector quantization over scalar quantization; The LBG algorithm.

Differential Encoding: Overview; Introduction; The basic algorithm; Prediction in DPCM; Adaptive DPCM; Delta modulation; Speech coding; Image coding.

PART - B

UNIT – 5

7 Hours

Some Mathematical Concepts, Transform coding: Some mathematical concepts: Linear systems; Sampling; Discrete Fourier transform; Z- transform. Transform coding: Overview; introduction; The transform; Transforms of interest; Quantization and coding for transform coefficients; Application to image compression – JPEG; Application to audio compression – MDCT.

UNIT – 6

6 Hours

Subband Coding, Audio Coding: Subband Coding: Overview; introduction; Filters; The basic subband coding algorithm; Bit allocation; Application to speech coding – G.722; Application to audio coding – MPEG audio; Application to image compression. Audio Coding: Overview; Introduction; MPEG audio coding; MPEG advanced audio coding; Dolby AC3; Other standards.

UNIT – 7

6 Hours

Wavelet-Based Compression: Overview; Introduction; Wavelets; Multiresolution and the scaling function; Implementation using Filters; Image compression; Embedded zerotree coder; Set partitioning in hierarchical trees; JPEG 2000.

UNIT – 8

7 Hours

Video Compression: Overview; Introduction; Motion compensation; Video signal representation; H.261; Model-based coding; Asymmetric applications; MPEG-1 and MPEG-2; H.263; H.264, MPEG-4 and advanced video coding; Packet video.

Text Books:

1. Khalid Sayood: Introduction to Data Compression, 3rd Edition, Elsevier, 2006. (Chapters 1, 2 excluding 2.2.1 and 2.4.3, 3.1, 3.2, 3.2.1, 3.8.2, 5, 7.1 to 7.5, 7.6, 7.6.1, 7.6.2, 8.1 to 8.3, 8.6, 9.1 to 9.5, 10.1 to 10.4, 11, 12.6 to 12.9, 13, 14.1 to 14.4, 14.9 to 14.12, 15, 16, 18.1 to 18.13)

Reference Books:

1. D. Salomon: Data Compression: The Complete Reference, Springer, 1998.

PATTERN RECOGNITION

Subject Code: 10CS664

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT – 2

7 Hours

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

UNIT – 3

7 Hours

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT – 4

6 Hours

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; k_n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

PART – B

UNIT – 5

7 Hours

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT – 6

6 Hours

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.

UNIT – 7

6 Hours

Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

UNIT – 8**7 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

Text Books:

1. Richard O. Duda, Peter E. Hart, and David G. Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.

Reference Books:

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

STOCHASTIC MODELS AND APPLICATIONS**Subject Code: 10CS665****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****6 Hours**

Introduction – 1: Axioms of probability; Conditional probability and independence; Random variables; Expected value and variance; Moment-Generating Functions and Laplace Transforms; conditional expectation; Exponential random variables.

UNIT – 2**6 Hours**

Introduction – 2: Limit theorems; Examples: A random graph; The Quicksort and Find algorithms; A self-organizing list model; Random permutations.

UNIT – 3**7 Hours**

Probability Bounds, Approximations, and Computations: Tail probability inequalities; The second moment and conditional expectation inequality; probability bounds via the Importance sampling identity; Poisson random variables and the Poisson paradigm; Compound Poisson random variables.

UNIT – 4**7 Hours**

Markov Chains: Introduction; Chapman-Kolmogorov Equations; Classification of states; Limiting and stationary probabilities; some

applications; Time-Reversible Markov Chains; Markov Chain Monte Carlo methods.

PART – B

UNIT – 5 **6 Hours**

The Probabilistic Method: Introduction; Using probability to prove existence; Obtaining bounds from expectations; The maximum weighted independent set problem: A bound and a random algorithm; The set covering problem; Antichains; The Lovasz Local lemma; A random algorithm for finding the minimal cut in a graph.

UNIT – 6 **6 Hours**

Martingales: Martingales: Definitions and examples; The martingale stopping theorem; The Hoeffding-Azuma inequality; Sub-martingales.

UNIT – 7 **7 Hours**

Poisson Processes, Queuing Theory – 1: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times
Queuing Theory: Introduction; Preliminaries; Exponential models

UNIT – 8 **7 Hours**

Queuing Theory – 2: Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

Text Books:

1. Sheldon M. Ross: Probability Models for Computer Science, Elsevier, 2002.

Reference Books:

1. B. R. Bhat: Stochastic Models Analysis and Applications, New Age International, 2000.
2. Scott L. Miller, Donald G. Childers: Probability and Random Processes with Applications to Signal Processing and Communications, Elsevier, 2004.

PROGRAMMING LANGUAGES

Subject Code: 10CS666

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Introduction; Names, Scopes, and Bindings: The art of language design; Programming language spectrum; Why study programming languages? Compilation and interpretation; Programming environments.

Names, scope, and bindings: The notion of binding time; Object lifetime and storage management; Scope rules; Implementing scope; The meaning of names within a scope; The binding of referencing environments; Macro expansion.

UNIT – 2

7 Hours

Control Flow: Expression evaluation; Structured and unstructured flow; Sequencing; Selection; Iteration; Recursion; Non-determinacy

UNIT – 3

6 Hours

Data Types: Type systems; Type checking; Records and variants; Arrays; Strings; Sets; Pointers and recursive types; Lists; Files and Input/Output; Equality testing and assignment.

UNIT – 4

6 Hours

Subroutines and Control Abstraction: Review of stack layout; Calling sequences; Parameter passing; Generic subroutines and modules; Exception handling; Coroutines; Events.

PART – B

UNIT – 5

6 Hours

Data Abstraction and Object Orientation: Object oriented programming; Encapsulation and Inheritance; Initialization and finalization; Dynamic method binding; Multiple inheritance; Object oriented programming revisited.

UNIT – 6**7 Hours**

Functional Languages, and Logic Languages: Functional Languages: Origins; Concepts; A review/overview of scheme; Evaluation order revisited; Higher-order functions; Functional programming in perspective. Logic Languages: Concepts; Prolog; Logic programming in perspective.

UNIT – 7**6 Hours**

Concurrency: Background and motivation; Concurrency programming fundamentals; Implementing synchronization; Language-level mechanisms; Message passing.

UNIT – 8**7 Hours**

Run-Time Program Management: Virtual machines; Late binding of machine code; Inspection/introspection.

Text Books:

1. Michael L. Scott: Programming Language Pragmatics, 3rd Edition, Elsevier, 2009.
(Chapters 1.1 to 1.5, 3.1 to 3.7, 6 excluding the sections on CD, 7 excluding the ML type system, 8, 9, 10 excluding the sections on CD, 11 excluding the sections on CD, 12, 15. Note: Text Boxes titled Design & Implementation are excluded)

Reference Books:

1. Ravi Sethi: Programming languages Concepts and Constructs, 2nd Edition, Pearson Education, 1996.
2. R Sebesta: Concepts of Programming Languages, 8th Edition, Pearson Education, 2008.
3. Allen Tucker, Robert Nonan: Programming Languages, Principles and Paradigms, 2nd Edition, Tata McGraw-Hill, 2007.

COMPUTER GRAPHICS AND VISUALIZATION LABORATORY**Subject Code: 10CSL67****I.A. Marks : 25****Hours/Week : 03****Exam Hours: 03****Total Hours : 42****Exam Marks: 50****PART - A****Design, develop, and implement the following programs in C / C++**

1. Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

2. Program to implement Liang-Barsky line clipping algorithm.
3. Program to draw a color cube and spin it using OpenGL transformation matrices.
4. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.
5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
6. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
7. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.
8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
10. Program to display a set of values $\{f_{ij}\}$ as a rectangular mesh.

PART - B

Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

Note:

1. Any question from Part A may be asked in the examination.
2. A report of about 10 – 12 pages on the package developed in Part B, duly certified by the department must be submitted during examination.

Instructions:

In the examination, one exercise from Part A is to be asked for a total of 30 marks. The package developed under Part B has to be evaluated for a total of 20 marks.

UNIX SYSTEM PROGRAMMING AND COMPILER DESIGN LABORATORY

Subject Code: 10CSL68

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

List of Experiments for USP: Design, develop, and execute the following programs

1. Write a C/C++ POSIX compliant program to check the following limits:
 - (i) No. of clock ticks
 - (ii) Max. no. of child processes
 - (iii) Max. path length
 - (iv) Max. no. of characters in a file name
 - (v) Max. no. of open files/ process
2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.
3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.
4. Write a C/C++ program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5.
 - a) Write a C/C++ program that outputs the contents of its Environment list
 - b) Write a C / C++ program to emulate the unix **ln** command
6. Write a C/C++ program to illustrate the race condition.
7. Write a C/C++ program that creates a zombie and then calls system to execute the **ps** command to verify that the process is zombie.
8. Write a C/C++ program to avoid zombie process by forking twice.
9. Write a C/C++ program to implement the **system** function.

10. Write a C/C++ program to set up a real-time clock interval timer using the **alarm** API.

List of Experiments for Compiler Design: Design, develop, and execute the following programs.

11. Write a C program to implement the syntax-directed definition of “if E then S1” and “if E then S1 else S2”. (Refer Fig. 8.23 in the text book prescribed for 06CS62 Compiler Design, Alfred V Aho, Ravi Sethi, and Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007).
12. Write a yacc program that accepts a regular expression as input and produce its parse tree as output.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VII

SEMESTER

OBJECT-ORIENTED MODELING AND DESIGN

Subject Code: 10CS71
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history

Modeling as Design Technique: Modeling; abstraction; The three models.

Class Modeling: Object and class concepts; Link and associations concepts;

Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

UNIT – 2

6 Hours

Advanced Class Modeling, State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – 3

6 Hours

Advanced State Modeling, Interaction Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.

Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

UNIT – 4

7 Hours

Process Overview, System Conception, Domain Analysis: Process Overview: Development stages; Development life cycle.

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

PART – B

UNIT – 5

7 Hours

Application Analysis, System Design: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

UNIT – 6

7 Hours

Class Design, Implementation Modeling, Legacy Systems: Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.

Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – 7

6 Hours

Design Patterns – 1: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description
Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

UNIT – 8

6 Hours

Design Patterns – 2, Idioms: Management Patterns: Command processor; View handler.

Idioms: Introduction; what can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
(Chapters 1 to 17, 23)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 1, 3.5, 3.6, 4)

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley- Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 2002.

EMBEDDED COMPUTING SYSTEMS

Sub Code: 10CS72
Hrs/Week: 04
Total Hrs: 52

IA Marks :25
Exam Hours :03
Exam Marks :100

PART- A

UNIT – 1 **6 Hours**

Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design

Design Example: Model Train Controller.

UNIT – 2 **7 Hours**

Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor.

UNIT – 3 **6 Hours**

Bus-Based Computer Systems: CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis

Design Example: Alarm Clock.

UNIT – 4 **7 Hours**

Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, Software performance optimization, Program-Level energy and power analysis, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.

PART- B

UNIT – 5 **6 Hours**

Real Time Operating System (RTOS) Based Design – 1: Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization.

UNIT – 6 **6 Hours**

RTOS-Based Design - 2: Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine

UNIT – 7

7 Hours

Distributed Embedded Systems: Distributed Network Architectures, Networks for Embedded Systems: I2C Bus, CAN Bus, SHARC Link Ports, Ethernet, Myrinet, Internet, Network Based Design. Design Example: Elevator Controller.

UNIT – 8

7 Hours

Embedded Systems Development Environment: The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler /Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging.

Text Books:

1. Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 2nd Edition, Elsevier, 2008.
2. Shibu K V: Introduction to Embedded Systems, Tata McGraw Hill, 2009
(Chapters 10, 13)

Reference Books:

1. James K. Peckol: Embedded Systems, A contemporary Design Tool, Wiley India, 2008
2. Tammy Neorgaard: Embedded Systems Architecture, Elsevier, 2005.

PROGRAMMING THE WEB

Subject Code: 10CS73

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

UNIT – 1

6 Hours

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox.

XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.

UNIT – 2**7 Hours****XHTML – 2, CSS: XHTML (continued):** Lists, Tables, Forms, Frames

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and <div> tags, Conflict resolution.

UNIT – 3**6 Hours**

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

UNIT – 4**7 Hours****Javascript and HTML Documents, Dynamic Documents with Javascript:**

The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification.

Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

PART - B**UNIT – 5****6 Hours**

XML: Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.

UNIT – 6**7 Hours**

Perl, CGI Programming: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.

The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies.

Database access with Perl and MySQL

UNIT – 7**6 Hours**

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control

statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

UNIT – 8

7 Hours

Ruby, Rails: Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
(Listed topics only from Chapters 1 to 9, 11 to 15)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. Xue Bai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

ADVANCED COMPUTER ARCHITECTURES

Subject Code: 10CS74

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

6 Hours

Fundamentals Of Computer Design: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

UNIT – 2

6 Hours

Pipelining: Introduction; Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

UNIT – 3

7 Hours

Instruction –Level Parallelism – 1: ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with

prediction; Overcoming Data hazards with Dynamic scheduling; Hardware-based speculation.

UNIT – 4

7 Hours

Instruction –Level Parallelism – 2: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

PART - B

UNIT – 5

7 Hours

Multiprocessors and Thread –Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared-memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency

UNIT – 6

6 Hours

Review of Memory Hierarchy: Introduction; Cache performance; Cache Optimizations, Virtual memory

UNIT – 7

6 Hours

Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

UNIT – 8

7 Hours

Hardware and Software for VLIW and EPIC: Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

Text Books:

1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 4th Edition, Elsevier, 2007.
(Chapter. 1.1 to 1.9, 2.1 to 2.10, 4.1to 4.6, 5.1 to 5.4, Appendix A, Appendix C, Appendix G)

Reference Books:

1. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability, 2nd Edition, Tata Mc Graw Hill, 2010.

2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

ADVANCED DBMS

Subject Code: 10CS751

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT – 1

7 Hours

Overview of Storage and Indexing, Disks and Files: Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning
Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats

UNIT – 2

7 Hours

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

UNIT – 3

6 Hours

Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, comparisons

UNIT – 4

6 Hours

Overview of Query Evaluation, External Sorting : The system catalog; Introduction to operator evaluation; Algorithms for relational operations; Introduction to query optimization; Alternative plans: A motivating example; what a typical optimizer does.
When does a DBMS sort data? A simple two-way merge sort; External merge sort

PART - B

UNIT – 5

6 Hours

Evaluating Relational Operators : The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering

UNIT – 6**7 Hours**

A Typical Relational Query Optimizer: Translating SQL queries in to Relational Algebra; Estimating the cost of a plan; Relational algebra equivalences; Enumeration of alternative plans; Nested sub-queries; other approaches to query optimization.

UNIT – 7**7 Hours**

Physical Database Design and Tuning: Introduction; Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.

UNIT – 8**6 Hours**

More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
(Chapters 8, 9, 10, 11, 12, 13.1 to 13.3, 14, 15, 20)
2. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
(Chapter 30)

Reference Books:

1. Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.

DIGITAL SIGNAL PROCESSING**Subject Code: 10CS752****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART - A****UNIT – 1****7 Hours**

The Discrete Fourier Transform: Its Properties and Applications : Frequency Domain Sampling; The Discrete Fourier Transform: Frequency Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to other Transforms. Properties of the DFT: Periodicity, Linearity and Symmetry Properties, Multiplication of Two DFT's and Circular Convolution, Additional DFT Properties; Linear Filtering

Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.

UNIT – 2

7 Hours

Efficient Computation of the DFT: Fast Fourier Transform Algorithms: Efficient Computation of the DFT: FFT Algorithms : Direct Computation of the DFT, Divide-and-Conquer Approach to Computation of the DFT, Radix-2 FFT Algorithms, Radix-4 FFT Algorithms, Split-Radix FFT Algorithms, Implementation of FFT Algorithms.

Applications of FFT Algorithms: Efficient computation of the DFT of Two Real Sequences, Efficient computation of the DFT of a $2N$ -Point Real Sequence, Use of the FFT Algorithm in Linear filtering and Correlation.

A Linear filtering approach to Computation of the DFT: The Goertzel Algorithm, The Chirp-Z Transform Algorithm.

Quantization Effects in the Computation of the DFT: Quantization Errors in the Direct Computation of the DFT, Quantization Errors in FFT Algorithms.

UNIT – 3

6 Hours

Implementation of Discrete-Time Systems – 1: Structures for the Realization of Discrete-Time Systems

Structures for FIR Systems: Direct-Form Structures, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Lattice and Lattice-Ladder Structures for IIR Systems.

UNIT – 4

6 Hours

Implementation of Discrete-Time Systems – 2: State-Space System Analysis and Structures: State-Space Descriptions of Systems Characterized by Difference Equations, Solution of the State-Space Equations, Relationships between Input-Output and State-Space Descriptions, State-Space Analysis in the Z-Domain, Additional State-Space Structures.

Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Numbers, Errors Resulting from Rounding and Truncation.

PART – B

UNIT – 5

6 Hours

Implementation of Discrete-Time Systems – 3: Quantization of Filter Coefficients: Analysis of Sensitivity to Quantization of Filter Coefficients, Quantization of Coefficients in FIR Filters

Round-Off Effects in Digital Filters: Limit-Cycle Oscillations in Recursive Systems, Scaling to Prevent Overflow, Statistical Characterization of Quantization effects in Fixed-Point Realizations of Digital Filters.

UNIT – 6

7 Hours

Design of Digital Filters – 1: General Considerations: Causality and its Implications, Characteristics of Practical Frequency-Selective Filters.

Design of FIR Filters: Symmetric And Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of FIR Differentiators, Design of Hilbert Transformers, Comparison of Design Methods for Linear-Phase FIR filters.

UNIT – 7

6 Hours

Design of Digital Filters – 2: Design of IIR Filters from Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, The Matched-Z Transformation, Characteristics of commonly used Analog Filters, Some examples of Digital Filters Designs based on the Bilinear Transformation.

UNIT – 8

7 Hours

Design of Digital Filters – 3: Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

Design of Digital Filters based on Least-Squares method: Padé Approximations method, Least-Square design methods, FIR least-Squares Inverse (Wiener) Filters, Design of IIR Filters in the Frequency domain.

Text Books:

1. John G. Proakis and Dimitris G. Manolakis: Digital Signal Processing, 3rd Edition, Pearson Education, 2003. (Chapters 5, 6, 7 and 8)

Reference Books:

1. Paulo S. R. Diniz, Eduardo A. B. da Silva And Sergio L. Netto: Digital Signal Processing: System Analysis and Design, Cambridge University Press, 2002.
2. Sanjit K. Mitra: Digital Signal Processing: A Computer Based Approach, Tata Mcgraw-Hill, 2001.
3. Alan V Oppenheim and Ronald W Schaffer: Digital Signal Processing, PHI, Indian Reprint, 2008.

JAVA AND J2EE

Subject Code:10CS753

Hours/Week: 4

Total Hours: 52

IA Marks: 25

Exam Marks: 100

Exam Hours: 3

PART - A

UNIT – 1

6 Hours

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs.

Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers.

Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Type casting; Strings

Control Statements: Selection statements, iteration statements, Jump Statements.

UNIT – 2

6 Hours

Classes, Inheritance, Exceptions, Applets : Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes.

Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading.

Exception handling: Exception handling in Java.

The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLETTAG; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT – 3

7 Hours

Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

UNIT – 4

7 Hours

Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

PART – B

UNIT – 5

6 Hours

Java 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE

The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

UNIT – 6

7 Hours

Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT – 7

6 Hours

JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

UNIT – 8

7 Hours

Enterprise Java Beans: Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Text Books:

1. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
(Chapters 1, 2, 3, 4, 5, 6, 8, 10, 11, 21, 22, 29, 30, 31)
2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.
(Chapters 5, 6, 11, 12, 15)

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.

MULTIMEDIA COMPUTING

Subject Code: 10CS754

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Media and Data Streams, Audio Technology: Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Defining Objects for Multimedia Systems; Multimedia Data Interface Standards; The need for Data Compression; Multimedia Databases.

Media: Perception Media, Representation Media, Presentation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values, and Presentation Dimensions; Key Properties of a Multimedia System: Discrete & Continuous Media, Independence Media, Computer Controlled Systems, Integration; Characterizing Data Streams: Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams.

Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission.

UNIT – 2

7 Hours

Graphics and Images, Video Technology, Computer-Based Animation: Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options.

Basics; Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language.

UNIT – 3

7 Hours

Data Compression – 1: Storage Space; Coding Requirements; Source, Entropy, and Hybrid Coding; Basic Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT- based Mode, Lossless Mode, Hierarchical Mode

UNIT – 4**6 Hours**

Data Compression – 2: H.261 (Px64) and H.263: Image Preparation, Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG-2, MPEG-4, MPEG-7; Fractal Compression.

PART - B**UNIT – 5****6 Hours**

Optical Storage Media: History of Optical Storage; Basic Technology; Video Discs and Other WORMs; Compact Disc Digital Audio; Compact Disc Read Only Memory; CD-ROM Extended Architecture; Further CD-ROM- Based Developments; Compact Disc Recordable; Compact Disc Magneto- Optical; Compact Disc Read/Write; Digital Versatile Disc.

UNIT – 6**6 Hours**

Content Analysis : Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications.

UNIT – 7**6 Hours**

Data and File Format Standards: Rich-Text Format; TIFF File Format; Resource Interchange File Format (RIFF); MIDI File Format; JPEG DIB File Format for Still and Motion Images; AVI Indeo File Format; MPEG Standards; TWAIN

UNIT – 8**7 Hours**

Multimedia Application Design : Multimedia Application Classes; Types of Multimedia Systems; Virtual Reality Design; Components of Multimedia Systems; Organizing Multimedia Databases; Application Workflow Design Issues; Distributed Application Design Issues.

Text Books:

1. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Vol 1- Media Coding and Content Processing, 2nd Edition, PHI, Indian Reprint 2008.
(Chapters 2, 3, 4, 5, 6, 7, 8, 9)
2. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.
(Chapters 1, 3, 7)

Reference Books:

1. K.R Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic: Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education, 2002.
2. Nalin K Sharad: Multimedia Information Networking, PHI, 2002.

DATA WAREHOUSING AND DATA MINING

Subject Code: 10CS755
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Data Warehousing:

Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses. Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata

UNIT – 2

6 Hours

Online Analytical Processing (OLAP): Introduction, Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Softwares.

UNIT – 3

6 Hours

Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications

UNIT – 4

8 Hours

Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating Frequent Itemsets, FP Growth Algorithm, Evaluation of Association Patterns

PART - B

UNIT – 5

6 Hours

Classification - 1 : Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, Nearest Neighbor Classifiers.

UNIT – 6

6 Hours

Classification - 2 : Bayesian Classifiers, Estimating Predictive accuracy of classification methods, Improving accuracy of clarification methods, Evaluation criteria for classification methods, Multiclass Problem.

UNIT – 7**8 Hours**

Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis

UNIT – 8**6 Hours**

Web Mining: Introduction, Web content mining, Text Mining, Unstructured Text, Text clustering, Mining Spatial and Temporal Databases.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2005.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Reference Books:

1. Arun K Pujari: Data Mining Techniques 2nd Edition, Universities Press, 2009.
2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publisher, 2006.
3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing, Mc GrawHill Publisher, 1997.

NEURAL NETWORKS**Subject Code: 10CS756****I.A. Marks : 25****Hours/Week : 04****Exam Hours: 03****Total Hours : 52****Exam Marks: 100****PART – A****UNIT – 1****7 Hours****Introduction**

What is a Neural Network?, Human Brain, Models of Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks.

UNIT – 2**6 Hours****Learning Processes – 1**

Introduction, Error-correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, Credit Assignment problem, Learning with a Teacher, Learning without a Teacher, Learning tasks, Memory, Adaptation.

UNIT – 3**7 Hours**

Learning Processes – 2, Single Layer Perceptrons: Statistical nature of the learning process, Statistical learning theory, Approximately correct model of learning.

Single Layer Perceptrons: Introduction, Adaptive filtering problem, Unconstrained optimization techniques, Linear least-squares filters, Least-mean square algorithm, Learning curves, Learning rate annealing techniques, Perceptron, Perceptron convergence theorem, Relation between the Perceptron and Bayes classifier for a Gaussian environment.

UNIT – 4

6 Hours

Multilayer Perceptrons – 1: Introduction, Some preliminaries, Back-propagation Algorithm, Summary of back-propagation algorithm, XOR problem, Heuristics for making the back-propagation algorithm perform better, Output representation and decision rule, Computer experiment, Feature detection, Back-propagation and differentiation.

PART - B

UNIT – 5

7 Hours

Multilayer Perceptrons – 2: Hessian matrix, Generalization, approximation of functions, Cross validation, Network pruning techniques, virtues and limitations of back- propagation learning, Accelerated convergence of back propagation learning, Supervised learning viewed as an optimization problem, Convolution networks.

UNIT – 6

6 Hours

Radial-Basic Function Networks – 1: Introduction, Cover's theorem on the separability of patterns, Interpolation problem, Supervised learning as an ill-posed Hypersurface reconstruction problem, Regularization theory, Regularization networks, Generalized radial-basis function networks, XOR problem, Estimation of the regularization parameter.

UNIT – 7

6 Hours

Radial-Basic Function Networks – 2, Optimization – 1: Approximation properties of RBF networks, Comparison of RBF networks and multilayer Perceptrons, Kernel regression and it's relation to RBF networks, Learning strategies, Computer experiment.

Optimization using Hopfield networks: Traveling salesperson problem, Solving simultaneous linear equations, Allocating documents to multiprocessors.

UNIT – 8

7 Hours

Optimization Methods – 2:

Iterated gradient descent, Simulated Annealing, Random Search, Evolutionary computation- Evolutionary algorithms, Initialization, Termination criterion, Reproduction, Operators, Replacement, Schema theorem

Text Books:

1. Simon Haykin: Neural Networks - A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999.
(Chapters 1.1-1.8, 2.1-2.15, 3.1-3.10, 4.1-4.19, 5.1-5.14)
2. Kishan Mehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.
(Chapters 7.1-7.5)

Reference Books:

1. B.Yegnanarayana: Artificial Neural Networks, PHI, 2001.

C# PROGRAMMING AND .NET

Subject Code: 10CS761

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

The philosophy of .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the .NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime

UNIT – 2

6 Hours

Building C# Applications: The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET

IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class

UNIT – 3

8 Hours

C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces

UNIT – 4

6 Hours

Object- Oriented Programming with C#: Forms Defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

PART – B

UNIT – 5

6 Hours

Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception(System. System Exception), Custom Application-Level Exception(System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System Exception Using VS. NET, Understanding Object Lifetime, the CIT of “new”, The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

UNIT – 6

6 Hours

Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator (IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (I Comparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type)

UNIT – 7

8 Hours

Callback Interfaces, Delegates, and Events, Advanced Techniques: Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer . Using C# Indexer from VB .NET. Overloading operators, The Internal Representation of Overloading Operators, interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom Conversion Routines, Defining Implicit Conversion Routines, The Internal Representations of Customs Conversion Routines

UNIT – 8

6 Hours

Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#. Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly, Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details), Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly

Text Books:

1. Andrew Troelsen: Pro C# with .NET 3.0, 4th Edition, Wiley India, 2009.
Chapters: 1 to 11 (up to pp.369)
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.

(Programming Examples 3.7, 3.10, 5.5, 6.1, 7.2, 7.4, 7.5, 7.6, 8.1, 8.2, 8.3, 8.5, 8.7, 8.8, 9.1, 9.2, 9.3, 9.4, 10.2, 10.4, 11.2, 11.4, 12.1, 12.4, 12.5, 12.6, 13.1, 13.2, 13.3, 13.6, 14.1, 14.2, 14.4, 15.2, 15.3, 16.1, 16.2, 16.3, 18.3, 18.5, 18.6)

Reference Books:

1. Tom Archer: Inside C#, WP Publishers, 2001.
2. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill, 2004.

DIGITAL IMAGE PROCESSING

Subject Code: 10CS762

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Digitized Image and its properties: Basic concepts, Image digitization, Digital image properties

UNIT – 2

7 Hours

Image Preprocessing: Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3

7 Hours

Segmentation – 1: Thresholding, Edge-based segmentation.

UNIT – 4

7 Hours

Segmentation – 2: Region based segmentation, Matching.

PART – B

UNIT – 5

7 Hours

Image Enhancement: Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT – 6

6 Hours

Image Compression: Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT – 7**7 Hours**

Shape representation: Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 8**6 Hours**

Morphology: Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

Text Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision, 2nd Edition, Thomson Learning, 2001.
(Chapters 2, 4.1 to 4.3, 5.1 to 5.4, 6, 11.1 to 11.4, 11.7)
2. Rafael C Gonzalez and Richard E Woods: Digital Image Processing, 3rd Edition, Pearson Education, 2003.
(Chapters 3.1 to 3.7, 4.1 to 4.5, 8.1 to 8.5)

Reference Books:

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI, 1997, Indian Reprint 2009.
2. B.Chanda, D Dutta Majumder, “Digital Image Processing and Analysis”, PHI, 2002.

GAME THEORY**Subject Code: 10CS763****Hours/Week : 04****Total Hours : 52****I.A. Marks : 25****Exam Hours: 03****Exam Marks: 100****PART - A****UNIT – 1****8 Hours**

Introduction, Strategic Games: What is game theory? The theory of rational choice; Interacting decision makers.

Strategic games; Examples: The prisoner’s dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria.

UNIT – 2**6 Hours**

Mixed Strategy Equilibrium: Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed, Illustration: Expert Diagnosis; Equilibrium in a single population, Illustration: Reporting a crime; The formation of players' beliefs; Extensions; Representing preferences by expected payoffs.

UNIT – 3**6 Hours**

Extensive Games: Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg's model of duopoly, Buying votes.

UNIT – 4**6 Hours**

Extensive games: Extensions and Discussions: Extensions: Allowing for simultaneous moves, Illustrations: Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry; Allowing for exogenous uncertainty, Discussion: subgame perfect equilibrium and backward induction.

PART – B**UNIT – 5****7 Hours**

Bayesian Games, Extensive Games with Imperfect Information: Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations.

Extensive games with imperfect information; Strategies; Nash equilibrium; Beliefs and sequential equilibrium; Signaling games; Illustration: Strategic information transmission.

UNIT – 6**7 Hours**

Strictly Competitive Games, Evolutionary Equilibrium: Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games.

Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio.

UNIT – 7**6 Hours**

Iterated Games: Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Some Nash equilibria of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.

UNIT – 8

6 Hours

Coalitional Games and Bargaining: Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, Exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining

Text Books:

1. Martin Osborne: An Introduction to Game Theory, Oxford University Press, Indian Edition, 2004.
(Listed topics only from Chapters 1 to 11, 13, 14, 16)

Reference Books:

1. Roger B. Myerson: Game Theory: Analysis of Conflict, Harvard University Press, 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green: Microeconomic Theory. Oxford University Press, New York, 1995.
3. Philip D. Straffin, Jr.: Game Theory and Strategy, The Mathematical Association of America, January 1993.

ARTIFICIAL INTELLIGENCE

Subject Code: 10CS764

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

UNIT – 2

7 Hours

Informed Search, Exploration, Constraint Satisfaction, Adversarial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction problems; Backtracking search

for CSPs. Adversarial search: Games; Optimal decisions in games; Alpha-Beta pruning.

UNIT – 3

6 Hours

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

UNIT – 4

6 Hours

First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting

PART – B

UNIT – 5

6 Hours

Inference in First-Order Logic – 2: Forward chaining; Backward chaining; Resolution.

UNIT – 6

7 Hours

Knowledge Representation: Ontological engineering; Categories and objects; Actions, situations, and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories; Reasoning with default information; Truth maintenance systems.

UNIT – 7

7 Hours

Planning, Uncertainty, Probabilistic Reasoning: Planning: The problem; Planning with state-space approach; Planning graphs; Planning with propositional logic.

Uncertainty: Acting under certainty; Inference using full joint distributions; Independence; Bayes' rule and its use.

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks.

UNIT – 8

6 Hours

Learning, AI: Present and Future: Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory.

AI: Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.
(Chapters 1.1, 2, 3.1 to 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1, 6.2, 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6, 14.1, 14.2, 14.3, 14.4, 18, 27)

Reference Books:

1. Elaine Rich, Kevin Knight: Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2009.
2. Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

STORAGE AREA NETWORKS

Subject Code: 10CS765

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART –A

UNIT - 1

7 Hours

Introduction to Information Storage and Management, Storage System Environment: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle

Components of Storage System Environment, Disk Drive Components, Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host, Application Requirements and Disk Performance.

UNIT - 2

6 Hours

Data Protection, Intelligent Storage system: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares

Components of an Intelligent Storage System, Intelligent Storage Array

UNIT - 3

7 Hours

Direct-Attached Storage, SCSI, and Storage Area Networks: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, Overview of Fibre Channel, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies.

UNIT - 4

6 Hours

NAS, IP SAN: General – Purpose Service vs. NAS Devices, Benefits of NAS, NAS File I / O, Components of NAS, NAS Implementations, NAS

File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. iSCSI, FCIP.

PART - B

UNIT - 5

6 Hours

Content-Addressed Storage, Storage Virtualization: Fixed Content and Archives, Types of Archive, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples

Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualizations Configurations, Storage Virtualization Challenges, Types of Storage Virtualization

UNIT - 6

6 Hours

Business Continuity, Backup and Recovery: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions.

Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies.

UNIT - 7

7 Hours

Local Replication, Remote Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure.

UNIT - 8

7 Hours

Securing the Storage Infrastructure, Managing the Storage Infrastructure: Storage Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking

Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution.

Text Books:

1. G. Somasundaram, Alok Shrivastava (Editors): Information Storage and Management, EMC Education Services, Wiley India, 2009.

Reference Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
2. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003.

3. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002.

FUZZY LOGIC

Subject Code: 10CS766
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT – 1

7 Hours

Introduction, Classical Sets and Fuzzy Sets: Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity.

Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions

Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hypercubes

UNIT – 2

6 Hours

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations - Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods

UNIT – 3

6 Hours

Membership Functions: Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.

UNIT – 4

7 Hours

Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic: Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods

Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers

Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors

PART - B

UNIT – 5

6 Hours

Classical Logic and Fuzzy Logic: Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR, Logical Proofs, Deductive Inferences. Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, Other forms of the Implication Operation, Other forms of the Composition Operation

UNIT – 6

6 Hours

Fuzzy Rule- Based Systems: Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference

UNIT – 7

7 Hours

Fuzzy Decision Making : Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multiobjective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.

UNIT – 8

7 Hours

Fuzzy Classification: Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering

Text Books:

1. Timothy J. Ross: Fuzzy Logic with Engineering Applications, 2nd Edition, Wiley India, 2006..
(Chapter 1 (pp 1-14), Chapter 2 (pp 17-34), Chapter 3 (pp 46-70), Chapter 4 (pp 87-122), Chapter 5 (pp 130-146), Chapter 6 (pp 151-178), Chapter 7 (pp 183-210), Chapter 8 (pp 232-254), Chapter 9 (pp 313-352), Chapter 10 (pp 371 – 400))

Reference Books:

1. B Kosko: Neural Networks and Fuzzy systems: A Dynamical System approach, PHI, 1991.

Networks Laboratory

Subject Code: 10CSL77

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

Note: Student is required to solve one problem from PART-A and one problem from PART-B. The questions are allotted based on lots. Both questions carry equal marks.

PART A – Simulation Exercises

The following experiments shall be conducted using either NS228/OPNET or any other suitable simulator.

1. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network with the links connected as follows:
n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
5. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
6. Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

PART-B

Implement the following in C/C++:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program for distance vector algorithm to find suitable path for transmission.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.

10. Implement the above program using as message queues or FIFOs as IPC channels.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Note:

In the examination, a combination of one problem has to be asked from Part A for a total of 25 marks and one problem from Part B has to be asked for a total of 25 marks. The choice must be based on random selection from the entire lots.

Web Programming Laboratory

Subject Code: 10CSL78

Hours/Week : 03

Total Hours : 42

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 50

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
 - a) Input: A number n obtained using prompt
Output: The first n Fibonacci numbers
 - b) Input: A number n obtained using prompt
Output: A table of numbers from 1 to n and their squares using **alert**
2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)
3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.
4. a) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include

USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

- b) Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.
5. a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc.
b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.
6. a) Write a Perl program to accept the User Name and display a greeting message randomly chosen from a list of 4 greeting messages.
b) Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a Perl program to display a digital clock which displays the current time of the server.
8. Write a Perl program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.
9. Write a PHP program to store current date-time in a COOKIE and display the „Last visited on” date-time on the web page upon reopening of the same page.
10. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
11. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
12. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Note: In the examination *each* student picks one question from the lot of *all* 12 questions.

VIII SEMESTER

SOFTWARE ARCHITECTURES

Subject Code: 10IS81

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT – 1

6 Hours

Introduction: The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views.

UNIT – 2

7 Hours

Architectural Styles and Case Studies: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Studies: Keyword in Context; Instrumentation software; Mobile robotics; Cruise control; Three vignettes in mixed style.

UNIT – 3

6 Hours

Quality: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics; Relationship of tactics to architectural patterns; Architectural patterns and styles.

UNIT – 4

7 Hours

Architectural Patterns – 1: Introduction; From mud to structure: Layers, Pipes and Filters, Blackboard.

PART – B

UNIT – 5 **7 Hours**

Architectural Patterns – 2: Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control.

UNIT – 6 **6 Hours**

Architectural Patterns – 3: Adaptable Systems: Microkernel; Reflection.

UNIT – 7 **6 Hours**

Some Design Patterns: Structural decomposition: Whole – Part; Organization of work: Master – Slave; Access Control: Proxy.

UNIT – 8 **7 Hours**

Designing and Documenting Software Architecture: Architecture in the life cycle; Designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; Choosing the relevant views; Documenting a view; Documentation across views.

Text Books:

1. Len Bass, Paul Clements, Rick Kazman: Software Architecture in Practice, 2nd Edition, Pearson Education, 2003.
(Chapters 1, 2, 4, 5, 7, 9)
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
(Chapters 2, 3.1 to 3.4)
3. Mary Shaw and David Garlan: Software Architecture- Perspectives on an Emerging Discipline, PHI, 2007.
(Chapters 1.1, 2, 3)

Reference Books:

1. E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns- Elements of Reusable Object-Oriented Software, Pearson Education, 1995.

Web Reference: <http://www.hillside.net/patterns/>

SYSTEM MODELING AND SIMULATION

Sub Code: 10CS82	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT – 1 8 Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

UNIT – 2 6 Hours

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing. Simulation in Java; Simulation in GPSS

UNIT – 3 6 Hours

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT – 4 6 Hours

Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues; Rough-cut modeling: An illustration..

PART – B

UNIT – 5 8 Hours

Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

UNIT – 6**6 Hours**

Input Modeling : Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – 7**6 Hours**

Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – 8**6 Hours**

Verification, Calibration, and Validation; Optimization: Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.
(Listed topics only from Chapters1 to 12)

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007.

WIRELESS NETWORKS AND MOBILE COMPUTING**Sub Code: 10CS831****IA Marks : 25****Hrs/Week: 04****Exam Hours : 03****Total Hrs: 52****Exam Marks : 100****PART-A****UNIT – 1****6 Hours**

Mobile Computing Architecture: Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing.

UNIT – 2 **7 Hours**

Wireless Networks – 1: GSM and SMS: Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications

UNIT – 3 **6 Hours**

Wireless Networks – 2: GPRS : GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS

UNIT – 4 **7 Hours**

Wireless Networks – 3: CDMA, 3G and WiMAX: Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

PART - B

UNIT – 5 **6 Hours**

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6

UNIT – 6 **7 Hours**

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development : The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

UNIT – 7 **6 Hours**

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

UNIT – 8 **7 Hours**

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet

event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

Text Books:

1. Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2d Edition, Tata McGraw Hill, 2010
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

WEB 2.0 AND RICH INTERNET APPLICATIONS

Sub Code: 10CS832

Hrs/ Week: 04

Total Hours: 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT – 1

6 Hours

Introduction, Ajax – 1: Web 2.0 and Rich Internet Applications, Overview of Ajax, Examples of usage of Ajax: Updating web page text, Chatting in real time, Dragging and dropping, Downloading images. Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XMLHttpRequest object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST, Using Ajax together with XML.

UNIT – 2

7 Hours

Ajax – 2: Handling multiple XMLHttpRequest objects in the same page, Using two XMLHttpRequest objects, Using an array of XMLHttpRequest objects, Using inner functions, Downloading JavaScript, connecting to Google Suggest, Creating google.php, Downloading from other domains with Ajax, HTML header request and Ajax, Defeating caching, Examples. Building XML and working with XML in JavaScript, Getting the document element, Accessing any XML element, Handling whitespace in Firefox, Handling cross-browser whitespace, Accessing XML data directly, Validating XML, Further examples of Rich Internet Applications with Ajax.

UNIT – 3**6 Hours**

Ajax – 3: Drawing user’s attention to downloaded text, Styling text, colors and background using CSS, Setting element location in the web pages, Setting the stacking order of web page elements, Further examples of using Ajax. Displaying all the data in an HTML form, Working with PHP server variables, Getting the data in to array format, Wrapping applications in to a single PHP page, Validating input from the user, Validating integers and text, DOM, Appending new elements to a web page using the DOM and Ajax, Replacing elements using the DOM, Handling timeouts in Ajax, Downloading images with Ajax, Example programs.

UNIT – 4**7 Hours**

Flex – 1 : Introduction: Understanding Flex Application Technologies, Using Flex Elements, Working with Data Services (Loading Data at Runtime), The Differences between Traditional and Flex Web Applications, Understanding How Flex Applications Work, Understanding Flex and Flash Authoring. Building Applications with the Flex Framework: Using Flex Tool Sets, Creating Projects, Building Applications, Deploying Applications Framework Fundamentals: Understanding How Flex Applications Are Structured, Loading and Initializing Flex Applications, Understanding the Component Life Cycles, Loading One Flex Application into Another Flex Application, Differentiating Between Flash Player and the Flex Framework, Caching the Framework, Understanding Application Domains, Localization, Managing Layout: Flex Layout Overview, Making Fluid Interfaces, Putting It All Together.

PART B**UNIT – 5****7 Hours**

Flex – 2: MXML: Understanding MXML Syntax and Structure, Making MXML Interactive Working with UI Components: Understanding UI Components, Buttons, Value Selectors, Text Components, List-Based Controls, Pop-Up Controls, Navigators, Control Bars Customizing Application Appearance: Using Styles, Skinning components, Customizing the preloader, Themes, Runtime CSS

UNIT – 6**6 Hours**

Flex – 3: ActionScript: Using ActionScript, MXML and ActionScript Correlations, Understanding ActionScript Syntax, Variables and Properties, Inheritance, Interfaces, Handling Events, Error Handling, Using XML

UNIT – 7**7 Hours**

Flex – 4: Managing State: Creating States, Applying States, Defining States, Adding and Removing Components, Setting Properties, Setting Styles,

Setting Event Handlers, Using Action Scripts to Define States, Managing Object Creation Policies, Handling State Events, Understanding State Life Cycles, When To Use States.Using Effects and Transitions: Using Effects, Creating Custom Effects, Using Transitions, Creating Custom Transitions.

UNIT – 8

6 Hours

Flex – 5: Working with Data: Using Data Models, Data Binding, Enabling Data Binding for Custom Classes, Data Binding Examples, Building data binding proxies. Validating and Formatting Data: Validating user input, Formatting Data.

Text Books:

1. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2009.
(Listed topics from Chapters 3, 4, 6, 7, 11, 12)
2. Chafic Kazon and Joey Lott: Programming Flex 3, O'Reilly, June 2009.
(Listed topics from Chapters 1 to 8, 12 to 15)

Reference Books:

1. Jack Herrington and Emily Kim: Getting Started with Flex 3, O'Reilly, 1st Edition, 2008.
2. Michele E. Davis and John A. Phillips: Flex 3 - A Beginner's Guide, Tata McGraw-Hill, 2008.
3. Colin Moock: Essential Actionscript 3.0, O'Reilly Publications, 2007.
4. Nicholas C Zakas et al : Professional Ajax, 2nd Edition, Wrox/Wiley India, 2008.

VLSI DESIGN AND ALGORITHMS

Sub Code: 10CS833

Hrs/Week: 04

Total Hrs: 52

IA Marks 25

Exam Hours : 03

Exam Marks : 100

PART - A

UNIT 1

6 Hours

Digital Systems and VLSI: Why design Integrated Circuits? Integrated Circuits manufacturing, CMOS Technology, Integrated Circuit Design Techniques, IP-based Design.

UNIT 2

8 Hours

Fabrication and Devices: Fabrication Processes, Transistors, Wires and vias, SCMOS Design Rules, Layout design and tools.

UNIT 3 **6 Hours**

Logic Gates – 1: Combinatorial logic functions, Static Complementary gates, Switch Logic.

UNIT 4 **6 Hours**

Logic Gates – 2: Alternative gate Circuits, Low Power gates, Delay through resistive interconnect; Delay through inductive interconnect, Design for yield, Gates as IP.

PART - B

UNIT 5 **6 Hours**

Combinational Logic Networks: Standard cell-based layout, Combinatorial network delay, Logic and interconnect design, Power Optimization, Switch logic networks, Combinational logic testing.

UNIT 6 **6 Hours**

Sequential Machines: Latches and Flip-flops, Sequential systems and clocking disciplines, Clock generators, Sequential systems design, Power optimization, Design validation, Sequential testing.

UNIT 7 **6 Hours**

Architecture Design: Register Transfer design, High Level Synthesis, Architecture for Low Power, Architecture testing.

UNIT 8 **8 Hours**

Design Problems and Algorithms : Placement and Partitioning: Circuit Representation, Wire-length Estimation, Types of Placement Problems, Placement Algorithms, Constructive Placement, Iterative Improvement, Partitioning, The Kernighan-Lin Partitioning Algorithm. Floor Planning: Concepts, Shape functions and floor plan sizing. Routing: Types of Local Routing Problems, Area Routing, Channel Routing, Introduction to Global Routing, Algorithms for Global Routing

Text Books:

1. Wayne Wolf: Modern VLSI Design - IP-Based Design, 4th Edition, PHI Learning, 2009.
(Listed topics only from Chapters 1 to 5, and 8)
2. Sabih H. Gerez: Algorithms for VLSI Design Automation, Wiley India, 2007.
(Listed topics only from Chapters 7, 8, and 9)

NETWORK MANAGEMENT SYSTEMS

Sub Code: 10CS834	IA Marks	25
Hrs/Week: 04	Exam Hours	03
Total Hrs: 52	Exam Marks	100

PART – A

UNIT 1

7 Hours

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

UNIT 2

6 Hours

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

UNIT 3

6 Hours

SNMPv1 Network Management - 1 : Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview.

UNIT 4

7 Hours

SNMPv1 Network Management – 2: The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

PART - B

UNIT 5

6 Hours

SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications; ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON.

UNIT 6

6 Hours

Broadband Network Management: ATM Networks: Broadband Networks and Services, ATM Technology – Virtual Path-Virtual Circuit, TM Packet Size, Integrated Service, SONET, ATM LAN Emulation, Virtual LAN; ATM Network Management – The ATM Network Reference Model, The Integrated Local Management Interface, The ATM Management Information Base, The Role of SNMP and ILMI in ATM Management, M1 Interface: Management of ATM Network Element, M2 Interface: Management of Private Networks, M3 Interface: Customer Network Management of Public Networks, M4 Interface: Public Network Management, Management of LAN Emulation, ATM Digital Exchange Interface Management.

UNIT 7

6 Hours

Broadband Network Management: Broadband Access Networks and Technologies – Broadband Access Networks, roadband Access Technology; HFCT Technology – The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

UNIT 8

8Hours

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem

Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Based Management, Service Level Management.

Text Books:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Edition, Pearson Education, 2010.

Reference Books:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

INFORMATION AND NETWORK SECURITY

Subject Code: 10CS835

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART – A

UNIT 1

6 Hours

Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print; Contingency plan and a model for contingency plan

UNIT 2

6 Hours

Security Technology-1: Introduction; Physical design; Firewalls; Protecting Remote Connections

UNIT 3

6 Hours

Security Technology – 2: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools

UNIT 4

8 Hours

Cryptography: Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography Tools; Attacks on Cryptosystems.

PART - B

UNIT 5 **8 Hours**
Introduction to Network Security, Authentication Applications: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs Kerberos, X.509 Directory Authentication Service.

UNIT 6 **6 Hours**
Electronic Mail Security: Pretty Good Privacy (PGP); S/MIME

UNIT 7 **6 Hours**
IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 8 **6 Hours**
Web Security: Web security requirements; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

Text Books:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005. (Chapters 5, 6, 7, 8; Exclude the topics not mentioned in the syllabus)
2. William Stallings: Network Security Essentials: Applications and Standards, 3rd Edition, Pearson Education, 2007. (Chapters: 1, 4, 5, 6, 7, 8)

Reference Book:

1. Behrouz A. Forouzan: Cryptography and Network Security, Special Indian Edition, Tata McGraw-Hill, 2007.

MICROCONTROLLER-BASED SYSTEMS

Subject Code: 10CS836
Hours/Week : 04
Total Hours : 52

I.A. Marks : 25
Exam Hours: 03
Exam Marks: 100

PART – A

UNIT 1 **7 Hours**
Introduction, 8051 Assembly Language Programming – 1: Microcontrollers and embedded processors; Overview of the 8051 family 8051 Assembly Language Programming (ALP) -1: Inside the 8051; Introduction to 8051 ALP; Assembling and running an 8051 program; The

PC and ROM space in 8051; Data types, directives, flag bits, PSW register, register banks, and the stack.

UNIT 2

6 Hours

ALP – 2 : Jump and loop instructions; Call instructions; Time delay for various 8051 family members; I/O programming; I/O bit manipulation programming. Immediate and register addressing modes; Accessing memory using various addressing modes.

UNIT 3

7 Hours

ALP – 3 - Programming in C: Bit addresses for I/O and RAM; Extra 128 bytes of on-chip RAM in 8052. Arithmetic instructions; Signed numbers and arithmetic operations; Logic and compare instructions; rotate instruction and serialization; BCD, ASCII, and other application programs. Programming in C: Data types and time delays; I/O programming; Logic operations; Data conversion programs; Accessing code ROM space; Data serialization.

UNIT 4

6 Hours

Pin Description, Timer Programming: Pin description of 8051; Intel Hex file; Programming the 8051 timers; Counter programming; Programming Timers 0 and 1 in C.

PART – B

UNIT 5

6 Hours

Serial Port Programming, Interrupt Programming: Basics of serial communications; 8051 connections to RS232; Serial port programming in assembly and in C 8051 interrupts; Programming timer interrupts; Programming external hardware interrupts; Programming the serial communications interrupt; Interrupt priority in 8051 / 8052; Interrupt programming in C.

UNIT 6

7 Hours

Interfacing LCD, Keyboard, ADC, DAC and Sensors : LCE interfacing; Keyboard interfacing; Parallel and serial ADC; DAC interfacing; Sensor interfacing and signal conditioning

UNIT 7

7 Hours

Interfacing to External Memory, Interfacing with 8255: Memory address decoding; Interfacing 8031 / 8051 with external ROM; 8051 data memory space; Accessing external data memory in C. Interfacing with 8255; Programming 8255 in C.

UNIT 8

6 Hours

DS12887 RTC interfacing and Programming, Applications : DS12887 RTC interfacing; DS12887 RTC programming in C; Alarm, SQW, and IRQ features of DS12886 Relays and opto-isolators; Stepper motor interfacing; DC motor interfacing and PWM

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay: The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd Edition, Pearson Education,2008.

Reference Books:

1. Raj Kamal: Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education, 2007.
2. Dr. Ramani Kalpathi, Ganesh Raja: Microcontrollers and Applications, 1st Revised Edition, Sanguine - Pearson, 2010.

ADHOC NETWORKS

Sub Code: 10CS841	IA Marks	: 25
Hrs/Week: 04	Exam Hours	: 03
Total Hrs: 52	Exam Marks	: 100

PART – A

UNIT 1 **6 Hours**

Introduction: Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT 2

7 Hours

MAC – 1: MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT 3 **6 Hours**

MAC – 2: Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4

7 Hours

Routing – 1: Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

PART- B

UNIT 5

6 Hours

Routing – 2: Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols

UNIT 6

7 Hours

Transport Layer: Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7

6 Hours

Security: Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

UNIT 8

7 Hours

QoS: Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions, MAC layer solutions, network layer solutions.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2005

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Adhoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

SOFTWARE TESTING

Subject Code: 10CS842

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT 1

6 Hours

A Perspective on Testing, Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT 2

7 Hours

Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing: Boundary value analysis, Robustness testing, Worst-case testing, Special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

UNIT 3

7 Hours

Path Testing, Data Flow Testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations. Definition-Use testing, Slice-based testing, Guidelines and observations.

UNIT 4

6 Hours

Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.

PART – B

UNIT 5

7 Hours

System Testing, Interaction Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. Context of

interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing,.

UNIT 6

7 Hours

Process Framework: Validation and verification, Degrees of freedom, Varieties of software. Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback. The quality process, Planning and monitoring, Quality goals, Dependability properties, Analysis, Testing, Improving the process, Organizational factors.

UNIT 7

6 Hours

Fault-Based Testing, Test Execution: Overview, Assumptions in fault-based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Test Execution: Overview, from test case specifications to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.

UNIT 8

6 Hours

Planning and Monitoring the Process, Documenting Analysis and Test: Quality and process, Test and analysis strategies and plans, Risk planning, Monitoring the process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
(Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 15)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
(Listed topics only from Chapters 2, 3, 4, 16, 17, 20, 24)

REFERENCE BOOKS:

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopaldaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.
3. Brian Marrick: The Craft of Software Testing, Pearson Education, 1995.

ARM BASED SYSTEM DESIGN

Subject Code: 10CS843

I.A. Marks: 25

Hours/Week: 4

Exam Marks: 100

Total Hours: 52

Exam Hours: 3

PART – A

UNIT 1

6 Hours

Introduction: The RISC design philosophy; The ARN design philosophy; Embedded system hardware and software.ARM processor fundamentals: Registers; Current Program Status Register; Pipeline; Exceptions, interrupts and the Vector Table; Core extensions; Architecture revisions; ARM processor families.

UNIT 2

7 Hours

ARM Instruction Set and Thumb Instruction Set: ARM instruction set: Data processing instructions; Branch instructions; Load-store instructions; Software interrupt instruction; Program Status Register functions; Loading constants; ARmv5E extensions; Conditional execution.Thumb instruction set: Thumb register usage; ARM –Thumb interworking; Other branch instructions; Data processing instructions; Single-Register Load-Store instructions; Multiple-Register Load-Store instructions; Stack instructions; Software interrupt instruction.

UNIT 3

6 Hours

Writing and Optimizing ARM Assembly Code: Writing assembly code; Profiling and cycle counting; Instruction scheduling; Register allocation; Conditional execution; Looping constructs; Bit manipulation; Efficient switches; Handling unaligned data.

UNIT 4

7 Hours

Optimized Primitives: Double-precision integer multiplication; Integer normalization and count leading zeros; Division; Square roots; Transcendental functions; Endian reversal and bit operations; Saturated and rounded arithmetic; Random number generation.

PART - B

UNIT 5

7 Hours

Exception and Interrupt Handling: Exception handling; Interrupts and interrupt handling schemes

UNIT 6**7 Hours**

Caches : The memory hierarchy and the cache memory; Cache architecture; Cache policy; Coprocessor 15 and cache; Flusing and cleaning cache memory; Cache lockdown; Caches and software performance.

UNIT 7**6 Hours**

Memory – 1: Memory Protection Units: Protected regions; Initializing the MPU, cache and write buffer; Demonstration of an MPU system. Memory Management Units: Moving from MPU to an MMU; How virtual memory works; Details of the ARM MMU.

UNIT 8**6 Hours**

Memory – 2: Page tables; The translation lookaside buffer; Domains and memory access permission; The caches and write buffer; Coprocessor 15 and MMU configuration; The fast context switch extension.

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright: ARM System Developer's Guide – Designing and Optimizing System Software, Elsevier, 2004.

Reference Books:

1. David Seal (Editor): ARM Architecture Reference Manual, 2nd Edition, Addison-Wesley, 2001.
2. Steve Furber: ARM System-on-Chip Architecture, 2nd Edition, Addison-Wesley, 2000.

SERVICES ORIENTED ARCHITECTURE**Subject Code: 10CS844****Hours/Week: 4****Total Hours: 52****I.A. Marks: 25****Exam Marks: 100****Exam Hours: 3****PART – A****UNIT 1****7 Hours**

Introduction o SOA, Evolution of SOA: Fundamental SOA; Common Characteristics of contemporary SOA; Common tangible benefits of SOA; An SOA timeline (from XML to Web services to SOA); The continuing evolution of SOA (Standards organizations and Contributing vendors); The roots of SOA (comparing SOA to Past architectures).

UNIT 2**6 Hours**

Web Services and Primitive SOA : The Web services framework; Services (as Web services); Service descriptions (with WSDL); Messaging (with SOAP).

UNIT 3**6 Hours**

Web Services and Contemporary SOA – 1: Message exchange patterns; Service activity; Coordination; Atomic Transactions; Business activities; Orchestration; Choreography

UNIT 4**7 Hours**

Web Services and Contemporary SOA – 2: Addressing; Reliable messaging; Correlation; Policies; Metadata exchange; Security; Notification and eventing

PART – B**UNIT 5****7 Hours**

Principles of Service – Orientation: Services-orientation and the enterprise; Anatomy of a service-oriented architecture; Common Principles of Service-orientation; How service orientation principles inter-relate; Service-orientation and object-orientation; Native Web service support for service-orientation principles.

UNIT 6**6 Hours**

Service Layers: Service-orientation and contemporary SOA; Service layer abstraction; Application service layer, Business service layer, Orchestration service layer; Agnostic services; Service layer configuration scenarios

UNIT 7**7 Hours**

Business Process Design: WS-BPEL language basics; WS-Coordination overview; Service-oriented business process design; WS-addressing language basics; WS-Reliable Messaging language basics

UNIT 8**6 Hours**

SOA Platforms: SOA platform basics; SOA support in J2EE; SOA support in .NET; Integration considerations

Text Books:

1. Thomas Erl: Service-Oriented Architecture – Concepts, Technology, and Design, Pearson Education, 2005.

Reference Books:

1. Eric Newcomer, Greg Lomow: Understanding SOA with Web Services, Pearson Education, 2005.

Clouds, Grids, and Clusters

Subject Code: 10CS845

Hours/Week: 4

Total Hours: 52

I.A. Marks: 25

Exam Marks: 100

Exam Hours: 3

PART – A

UNIT - 1

6 Hours

Introduction: Overview of Cloud Computing, Applications, Intranets and the Cloud, When can cloud Computing be used? Benefits and limitations, Security concerns, Regulatory issues

UNIT - 2

6 Hours

Business Case for Cloud, Examples of Cloud Services: Cloud computing services, Help to the business, Deleting the data center. Examples: Google, Microsoft, IBM, Salesforce.com and its uses, Cloud at Thomson Reuters.

UNIT - 3

7 Hours

Technology, Cloud Storage, Standards: Cloud Computing Technology: Clients, Security, Network, Services.
Overview of Cloud storage, Some providers of Cloud storage. Standards: Applications, Clients, Infrastructure, Service.

UNIT - 4

7 Hours

Other issues: Overview of SaaS (Software as a Service), Driving forces, Company offerings: Google, Microsoft, IBM. Software plus Service: Overview, Mobile device integration Local Clouds, Thin Clients, Migrating to the Cloud: Virtualization, Server solutions, Thin clients, Cloud services for individuals, mid-markets, and enterprises, Migration.

PART - B

UNIT - 5

7 Hours

GRID Computing – 1: Introduction: Data Center, The Grid and the Distributed/ High Performance Computing, Cluster Computing and Grid Computing, Metacomputing – the Precursor of Grid Computing, Scientific, Business and e-Governance Grids, Web services and Grid Computing, Business Computing and the Grid – a Potential Win win Situation, e-Governance and the Grid. Technologies and Architectures for Grid Computing: Clustering and Grid Computing, Issues in Data Grids, Key Functional Requirements in Grid Computing, Standards for Grid Computing, Recent Technological Trends in Large Data Grids. OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF (Web

Services Resource Framework), Resource Approach to Stateful Services, WSRF Specification.

The Grid and the Database: Issues in Database Integration with the Grid, The Requirements of a Grid enabled database, Storage Request Broker (SRB), How to integrate the Database with the Grid? The Architecture of OGSA- DAI for Offering Grid Database Services

UNIT - 6

6 Hours

GRID Computing – 2: World Wide Grid Computing Activites, Organizations and Projects: Standards Organizations, Organizations Developing Grid Computing Tool Kits, Framework and Middleware, Grid Projects and Organizations Building and Using Grid Based Solutions. Web Services and the Service Oriented Architecture (SOA): History and Background, Service Oriented Architecture, How a Web Service Works, SOAP and WSDL, Description, Creating Web Services, Server Side. Globus Toolkit: History of Globus Toolkit, Versions of Globus Toolkit, Applications of GT4 – cases, GT4 – Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data, Choreography and Coordination, Main Features of GT4 Functionality – a Summary, GT4 Architecture, GT4 Command Line Programs, GT4 Containers.

UNIT - 7

7 Hours

Cluster Computing – 1: Introduction: What is Cluster Computing, Approaches to Parallel Computing, How to Achieve Low Cost Parallel Computing through Clusters, Definition and Architecture of a Cluster, What is the Functionality a Cluster can offer? Categories of Clusters Cluster Middleware: Levels and Layers of Single System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools. Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures, High Throughput Computing Clusters, Condor. Setting up and Administering a Cluster: How to set up a Simple Cluster? Design considerations for the Front End of a Cluster, Setting up nodes, Clusters of Clusters or Metaclusters, System Monitoring, Directory Services inside the Clusters & DCE, Global Clocks Sync, Administering heterogeneous Clusters.

UNIT - 8

6 Hours

Cluster Computing – 2: Cluster Technology for High Availability: Highly Available Clusters, High Availability Parallel Computing, Mission Critical (or Business Critical or Business Continuity) Applications, Types of Failures and Errors, Cluster Architectures and Configurations for High Availability, Faults and Error Detection, Failure Recovery, Failover / Recovery Clusters. Performance Model and Simulation: Performance Measures and Metrics, Profit Effectiveness of Parallel Computing through Clusters. Process Scheduling, Load Sharing and Load Balancing: Job Management System

(JMS) Resource Management System (RMS), Queues, Hosts, Resources, Jobs and Policies, Policies for Resource Utilization, Scheduling Policies Load Sharing and Load Balancing, Strategies for Load Balancing, Modeling Parameters Case Studies of Cluster Systems: Beowulf, PARAM.

Text Books:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Hill, 2010.
2. Prabhu: Grid and Cluster Computing, PHI, 2008.

Reference Books:

1. Joshy Joseph, Craig Fellenstein: Grid Computing, Pearson Education, 2007.
2. Internet Resources

MULTI-CORE ARCHITECTURE AND PROGRAMMING

Subject Code: 10CS846

Hours/Week : 04

Total Hours : 52

I.A. Marks : 25

Exam Hours: 03

Exam Marks: 100

PART - A

UNIT 1

7 Hours

Introduction

The power and potential of parallelism, Examining sequential and parallel programs, Parallelism using multiple instruction streams, The Goals: Scalability and performance portability, Balancing machine specifics with portability, A look at six parallel computers: Chip multiprocessors, Symmetric multiprocessor architectures, Heterogeneous chip designs, Clusters, Supercomputers, Observations from the six parallel computers.

UNIT 2

6 Hours

Reasoning about Performance

Motivation and basic concepts, Sources of performance loss, Parallel structure, Performance trade-offs, Measuring performance, Scalable performance.

UNIT 3

6 Hours

Examples of Multi-Core Architectures

Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller; Intel Core i7: Architecture, The Intel Core i7 Processor, Intel QuickPath Interconnect, The SCH; Intel Atom Architecture.

Introduction to Texas Instruments' Multi-Core Multilayer SoC architecture for communications, infrastructure equipment

UNIT 4 **7 Hours**

Parallel Algorithm Design

Introduction, The Task / Channel model, Foster's design methodology, Examples: Boundary value problem, Finding the maximum, The n-Body problem, Adding data input.

PART – B

UNIT 5 **7 Hours**

Parallel Programming – 1 (Using OpenMP)

Designing for threads: Task decomposition, Data decomposition, Data flow decomposition, Implications of different decompositions; Challenges in decomposition, Parallel programming patterns, A motivating problem: Error diffusion.

Threading and Parallel Programming Constructs: Synchronization, Critical sections, Deadlocks, Synchronization primitives: Semaphores, Locks, Condition variables; Messages, Flow Control-Based concepts: Fence, Barrier; Implementation-Dependent threading issues.

UNIT 6 **6 Hours**

Parallel Programming – 2 (Using OpenMP)

Introduction, The shared-memory model, Parallel *for* loops, Declaring private variables, Critical sections, Reductions, Performance improvements, More general data parallelism, Functional parallelism.

UNIT 7 **7 Hours**

Solutions to Common Parallel Programming Problems

Too many threads, Data races, deadlocks, and live locks, Heavily contended locks, Non-blocking algorithms, Thread-safe functions and libraries, Memory issues, Cache-related issues, Avoiding pipeline stalls, Data organization for high performance.

UNIT 8 **6 Hours**

Threading in the Processor

Single-Core Processors: Processor architecture fundamentals, Comparing Superscalar and EPIC architectures.

Multi-Core Processors: Hardware-based threading, Hyper-threading technology, Multi-Core processors, Multiple processor interactions, Power consumption, Beyond multi-core architecture.

NOTE: In order to acquire a sound understanding of the subject, it is desirable for the students to work in the laboratory using OpenMP. The

hands-on experience would reinforce the concepts learnt in theory. Problems similar to the ones solved in the Algorithms Laboratory can be solved and issues like speed-up achieved can be analyzed in depth. Several free tools are available from companies like INTEL to facilitate such a study.

Text Books:

1. Calvin Lin, Lawrence Snyder: Principles of Parallel Programming, Pearson Education, 2009.
(Listed topics only from Chapters 1, 2, 3)
2. Michael J. Quinn: Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2004.
(Listed topics only from Chapters 3, 17)
3. Shameem Akhter, Jason Roberts: Multi-Core Programming, Increasing Performance through Software Multithreading, Intel Press, 2006.
(Listed topics only from Chapters 3, 4, 7, 9, 10)
4. Web resources for Example Architectures of INTEL and Texas Instruments:
<http://download.intel.com/design/intarch/papers/321087.pdf> ;
<http://focus.ti.com/lit/wp/spry133/spry133.pdf>

Reference Books:

1. Introduction to Parallel Computing – Ananth Grama et. al., Pearson Education, 2009.
2. Reinders : Intel Threading Building Blocks, O'reilly –2005
3. David Culler et. al.: Parallel Computer Architecture: A Hardware/Software Approach, Elsevier, 2006.
4. Richard Gerber, Aart J.C. Bik, Kevin B. Smith, Xinmin Tian: Software Optimization Cookbook, High-Performance Recipes for IA-32 Platforms, 2nd Edition, Intel Press, 2006.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT31	Engineering Mathematics - III	04	--	03	80	20	100	4
2	15CS32	Analog and Digital Electronics	04	--	03	80	20	100	4
3	15CS33	Data Structures and Applications	04	--	03	80	20	100	4
4	15CS34	Computer Organization	04	--	03	80	20	100	4
5	15CS35	Unix and Shell Programming	04	--	03	80	20	100	4
6	15CS36	Discrete Mathematical Structures	04	--	03	80	20	100	4
7	15CSL37	Analog and Digital Electronics Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL38	Data Structures Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT41	Engineering Mathematics - IV	04	--	03	80	20	100	4
2	15CS 42	Software Engineering	04	--	03	80	20	100	4
3	15CS43	Design and Analysis of Algorithms	04	--	03	80	20	100	4
4	15CS 44	Microprocessors and Microcontrollers	04	--	03	80	20	100	4
5	15CS45	Object Oriented Concepts	04	--	03	80	20	100	4
6	15CS46	Data Communication	04	--	03	80	20	100	4
7	15CSL47	Design and Analysis of Algorithm Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL48	Microprocessors Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS51	Management and Entrepreneurship for IT Industry	04	--	03	80	20	100	4
2	15CS52	Computer Networks	04	--	03	80	20	100	4
3	15CS53	Database Management System	04	--	03	80	20	100	4
4	15CS54	Automata theory and Computability	04	--	03	80	20	100	4
5	15CS55x	Professional Elective 1	03	--	03	80	20	100	3
6	15CS56x	Open Elective 1	03	--	03	80	20	100	3
7	15CSL57	Computer Network Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL58	DBMS Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 1		Open Elective	
15CS553	Advanced JAVA and J2EE	15CS564	Dot Net framework for application development;

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. Computer Science & Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS61	Cryptography, Network Security and Cyber Law	04	--	03	80	20	100	4
2	15CS62	Computer Graphics and Visualization	04	--	03	80	20	100	4
3	15CS63	System Software and Compiler Design	04	--	03	80	20	100	4
4	15CS64	Operating Systems	04	--	03	80	20	100	4
5	15CS65x	Professional Elective 2	03	--	03	80	20	100	3
6	15CS66x	Open Elective 2	03	--	03	80	20	100	3
7	15CSL67	System Software and Operating System Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL68	Computer Graphics Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 2		Open elective	
15CS651	Data Mining and Data Warehousing	15CS664	Python Application Programming

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks		Total Marks
1	15CS71	Web Technology and its applications	04	--	03	20	80	100	4
2	15CS72	Advanced Computer Architectures	04	--	03	20	80	100	4
3	15CS73	Machine Learning	04	--	03	20	80	100	4
4	15CS74x	Professional Elective 3	03	--	03	20	80	100	3
5	15CS75x	Professional Elective 4	03	--	03	20	80	100	3
6	15CSL76	Machine Learning Laboratory	--	1I+2P	03	20	80	100	2
7	15CSL77	Web Technology Laboratory with mini project	--	1I+2P	03	20	80	100	2
8	15CSP78	Project Phase 1 + Seminar	--	--	--	100	--	100	2
TOTAL			18	6	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CS742	Cloud Computing and its Applications	15CS754	Storage Area Networks

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Project Phase 1 + Seminar : Literature Survey, Problem Identification, Objectives and Methodology, Submission of Synopsis and Seminar

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering
 VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS81	Internet of Things and Applications	4	--	3	20	80	100	4
2	15CS82	Big Data Analytics	4	--	3	20	80	100	4
3	15CS83x	Professional Elective 5	3	--	3	20	80	100	3
4	15CS84	Internship / Professional Practice	Industry Oriented		3	50	50	100	2
5	15CSP85	Project work phase II	--	6	3	100	100	200	5
6	15CSS86	Seminar	--	4	--	100	--	100	2
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CS834	System Modeling and Simulation

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Internship / Professional Practice: To be carried out between 6th and 7th semester vacation or 7th and 8th semester vacation period

ENGINEERING MATHEMATICS-III

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Comprehend and use of analytical and numerical methods in different engineering fields • Apprehend and apply Fourier Series • Realize and use of Fourier transforms and Z-Transforms • Use of statistical methods in curve fitting applications • Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation 			
Module -1			Teaching Hours
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of Periodic functions with period 2π and with arbitrary period $2c$, Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis. Complex Fourier series</p>			10Hours
Module -2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse transform. Z-transform: Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.</p>			10 Hours
Module – 3			
<p>Statistical Methods: Correlation and rank Correlation coefficients, Regression and Regression coefficients, lines of regression - problems Curve fitting: Curve fitting by the method of least squares, Fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}, y = ax^b$. Numerical Methods: Numerical solution of algebraic and transcendental equations by: Regular-falsi method, Secant method, Newton - Raphson method and Graphical method.</p>			10 Hours
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula. Central Difference-Stirling's and Bessel's formulae (all formulae without proof)-Problems. Numerical integration: Simpson's 1/3, 3/8 rule, Weddle's rule (without proof) -Problems</p>			10 Hours

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem (without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, minimal surface of revolution, hanging chain, problems</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> • Use of periodic signals and Fourier series to analyze circuits • Explain the general linear system theory for continuous-time signals and systems using the Fourier Transform • Analyze discrete-time systems using convolution and the z-transform • Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral • Use curl and divergence of a vector function in three dimensions, as well as apply the Green's Theorem, Divergence Theorem and Stokes' theorem in various applications • Solve the simple problem of the calculus of variations 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 4. Conduct Investigations of Complex Problems 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013. 2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 	
Reference Books:	
<ol style="list-style-type: none"> 1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley. 3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed. 	

ANALOG AND DIGITAL ELECTRONICS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT • Evolve and Analyze Operational Amplifier circuits and their applications • Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques. • Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops. • Describe, Design and Analyze Synchronous and Asynchronous Sequential • Explain and design registers and Counters, A/D and D/A converters. 			
Module -1			Teaching Hours
<p>Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter.</p> <p>Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)</p>			10 Hours
Module -2			
<p>The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.</p> <p>Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.</p>			10 Hours
Module – 3			

<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>	10 Hours
Module-4	
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>	10 Hours
Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
Course outcomes: After Studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions(partly) 3. Modern Tool Usage 4. Problem Analysis 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

DATA STRUCTURES AND APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Illustrate linear representation of data structures: Stack, Queues, Lists • Illustrate linear representation of data structures: Trees, Graphs • Demonstrate sorting and searching algorithms • Find suitable data structure during application development/Problem Solving 			
Module -1			Teaching Hours
<p>Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4</p>			10 Hours
Module -2			
<p>Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13</p>			10 Hours
Module – 3			

<p>Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples</p> <p>Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10</p>	10 Hours
Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7 Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Use different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Use stack, Queue, Lists, Trees and Graphs in problem solving • Implement all data structures in a high-level language for problem solving. 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions 3. Conduct Investigations of Complex Problems 4. Problem Analysis for suitability of data structures. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	

Text Books:

1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014
2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014

Reference Books:

1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning, 2014
2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012
3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013
4. Data Structures using C - A M Tenenbaum, PHI, 1989
5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives:			
This course will enable the students to			
<ul style="list-style-type: none"> • Explain the basic sub systems of a computer, their organization, structure and operation. • Illustrate the concept of programs as sequences of machine instructions. • Demonstrate different ways of communicating with I/O devices and standard I/O interfaces. • Describe memory hierarchy and concept of virtual memory. • Describe arithmetic and logical operations with integer and floating-point operands. • Illustrate organization of a simple processor, pipelined processor and other computing systems. 			
Module -1			Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions			10Hours
Module -2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.			10 Hours
Module – 3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.			10 Hours
Module-4			
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.			10 Hours
Module-5			

<p>Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.</p>	<p>10 Hours</p>
<p>Course outcomes: After studying this course, students will be able to:</p>	
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Design and analyse simple arithmetic and logical units. 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12) 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 	

UNIX AND SHELL PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Illustrate the UNIX system architecture and use of basic Commands. • Use of editors and networking commands. • Demonstrate writing shell scripts. • Categorize, compare and make use of UNIX system calls. 			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			10Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			10Hours

Module – 3	
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>	10Hours
Module-4	
<p>Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.</p> <p>Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2</p>	10Hours
Module-5	
<p>Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.</p> <p>Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.</p> <p>Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1</p>	10Hours
Course outcomes:	

After studying this course, students will be able to:

- Explain UNIX system and use different commands.
- Write Shell scripts for certain functions on different subsystems.
- Demonstrate use of editors and Perl script writing

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Environment and Sustainability
3. Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition , Wiley,2014.

DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Provide theoretical foundations of computer science to perceive other courses in the programme. • Illustrate applications of discrete structures: logic, relations, functions, set theory and counting. • Describe different mathematical proof techniques, • Illustrate the use of graph theory in computer science. 			
Module -1			Teaching Hours
<p>Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,</p>			10Hours
Module -2			
<p>Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.</p>			10 Hours
Module – 3			
<p>Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.</p>			10 Hours
Module-4			
<p>The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,</p>			10 Hours
Module-5			
<p>Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes</p>			10 Hours

<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Application of different mathematical proofs techniques in proving theorems in the courses. • Compare graphs, trees and their applications.
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Conduct Investigations of Complex Problems 4. Design/Development of Solutions.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007. 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010. 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004. 5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER - III

Laboratory Code	15CSL37	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enable students to get practical experience in design, assembly and evaluation/testing of

- Analog components and circuits including Operational Amplifier, Timer, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and registers using flip-flops.
- Synchronous and Asynchronous sequential circuits.
- A/D and D/A converters

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 20 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

Continued:

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

Study experiment

12. To study 4-bit ALU using IC-74181.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
- Design and demonstrate various combinational logic circuits.
- Design and demonstrate various types of counters and Registers using Flip-flops
- Use simulation package to design circuits.
- Understand the working and implementation of ALU.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Modern Tool Usage

Conduction of Practical Examination:

1. All laboratory experiments (1 to 11 nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script.
4. Marks distribution:
 - a) For questions having part a only- Procedure + Conduction + Viva: **20 + 50 + 10 = 80 Marks**
 - b) For questions having part a and b
 - Part a- Procedure + Conduction + Viva: **10 + 35 + 05 = 50 Marks**
 - Part b- Procedure + Conduction + Viva: **10 + 15 + 05 = 30 Marks**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

DATA STRUCTURES LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Laboratory Code	15CSL38	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 02

Course objectives:

This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Asymptotic performance of algorithms.
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs
- Sorting and searching algorithms

Descriptions (if any)

Implement all the experiments in C Language under Linux / Windows environment.

Laboratory Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following **Array** operations
 - a. Creating an Array of N Integer Elements
 - b. Display of Array Elements with Suitable Headings
 - c. Inserting an Element (**ELEM**) at a given valid Position (**POS**)
 - d. Deleting an Element at a given valid Position(**POS**)
 - e. Exit.Support the program with functions for each of the above operations.
2. Design, Develop and Implement a Program in C for the following operations on **Strings**
 - a. Read a main String (**STR**), a Pattern String (**PAT**) and a Replace String (**REP**)
 - b. Perform Pattern Matching Operation: Find and Replace all occurrences of **PAT** in **STR** with **REP** if **PAT** exists in **STR**. Report suitable messages in case **PAT** does not exist in **STR**Support the program with functions for each of the above operations. Don't use Built-in functions.
3. Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
 - a. **Push** an Element on to Stack
 - b. **Pop** an Element from Stack
 - c. Demonstrate how Stack can be used to check **Palindrome**
 - d. Demonstrate **Overflow** and **Underflow** situations on Stack
 - e. Display the status of Stack

f. Exit

Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(**Remainder**), ^(Power) and **alphanumeric** operands.
5. Design, Develop and Implement a Program in C for the following Stack Applications
 - a. Evaluation of **Suffix expression** with single digit operands and operators: +, -, *, /, %, ^
 - b. Solving **Tower of Hanoi** problem with **n** disks
6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
 - a. Insert an Element on to Circular QUEUE
 - b. Delete an Element from Circular QUEUE
 - c. Demonstrate **Overflow** and **Underflow** situations on Circular QUEUE
 - d. Display the status of Circular QUEUE
 - e. Exit

Support the program with appropriate functions for each of the above operations

Continued:

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: **USN, Name, Branch, Sem, PhNo**
 - a. Create a **SLL** of **N** Students Data by using **front insertion**.
 - b. Display the status of **SLL** and count the number of nodes in it
 - c. Perform Insertion / Deletion at End of **SLL**
 - d. Perform Insertion / Deletion at Front of **SLL(Demonstration of stack)**
 - e. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: **SSN, Name, Dept, Designation, Sal, PhNo**
 - a. Create a **DLL** of **N** Employees Data by using **end insertion**.
 - b. Display the status of **DLL** and count the number of nodes in it
 - c. Perform Insertion and Deletion at End of **DLL**
 - d. Perform Insertion and Deletion at Front of **DLL**
 - e. Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - f. Exit

<p>9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) <p>Support the program with appropriate functions for each of the above operations</p> <p>10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers</p> <ol style="list-style-type: none"> Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message Exit <p>11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method <p>12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K → L as $H(K) = K \bmod m$ (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Analyze and Compare various linear and non-linear data structures Code, debug and demonstrate the working nature of different types of data structures and their applications Implement, analyze and evaluate the searching and sorting algorithms Choose the appropriate data structure for solving real world problems
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> Engineering Knowledge Problem Analysis Design/Development of Solutions Modern Tool Usage
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments (TWELVE nos) are to be included for practical examination. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80) Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate, solve and analyze engineering problems. • Apply numerical methods to solve ordinary differential equations. • Apply finite difference method to solve partial differential equations. • Perform complex analysis. • Interpret use of sampling theory. • Apply joint probability distribution and stochastic process. 			
Module 1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Picard’s method, Taylor’s series method, modified Euler’s method, Runge-Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard’s method, Runge-Kutta method of fourth order			10 Hours
Module 2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Picard’s method, Runge-Kutta method and Milne’s method. Special Functions: Bessel’s functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre’s functions - Legendre’s polynomial, Rodrigue’s formula, problems.			10 Hours
Module 3			
Complex Variables: Function of a complex variable, limits, continuity, differentiability,. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem with proof and problems. Transformations: Conformal transformations, discussion of transformations: $w = z + iy$, $w = z^2$, $w = z + (1/z)$ and bilinear transformations.			10 Hours
Module 4			
Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.			10 Hours
Module 5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.			10 Hours

<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use appropriate numerical methods to solve first and second order ordinary differential equations. • Use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction. • State and prove Cauchy's theorem and its consequences including Cauchy's integral formula. • Compute residues and apply the residue theorem to evaluate integrals. • Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods.
<p>Graduate Attributes</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-Long Learning • Conduct Investigations of Complex Problems
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013. 3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

SOFTWARE ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Outline software engineering principles and activities involved in building large software programs. • Identify ethical and professional issues and explain why they are of concern to software engineers. • Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. • Differentiate system models, use UML diagrams and apply design patterns. • Discuss the distinctions between validation testing and defect testing. • Recognize the importance of software maintenance and describe the intricacies involved in software evolution. • Apply estimation techniques, schedule project activities and compute pricing. • Identify software quality parameters and quantify software using measurements and metrics. • List software quality standards and outline the practices involved. • Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility. 			
Module 1			Teaching Hours
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities. Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).			12 Hours
Module 2			
System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-Oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).			11 Hours
Module 3			
Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695). Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).			9 Hours

Module 4	
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)	10 Hours
Module 5	
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “ The SCRUM Primer, Ver 2.0 ”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):	8 Hours
Course Outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Use the techniques, skills, and modern engineering tools necessary for engineering practice • Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Project Management and Finance • Conduct Investigations of Complex Problems • Modern Tool Usage • Ethics 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24) 2. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf 	
Reference Books:	
<ol style="list-style-type: none"> 1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India 	
Web Reference for eBooks on Agile:	
<ol style="list-style-type: none"> 1. http://agilemanifesto.org/ 2. http://www.jamesshore.com/Agile-Book/ 	

DESIGN AND ANALYSIS OF ALGORITHMS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain various computational problem solving techniques. • Apply appropriate method to solve a given problem. • Describe various methods of algorithm analysis. 			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen’s matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim’s Algorithm, Kruskal’s Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall’s Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic			10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education) 	

MICROPROCESSORS AND MICROCONTROLLERS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Make familiar with importance and applications of microprocessors and microcontrollers
- Expose architecture of 8086 microprocessor and ARM processor
- Familiarize instruction set of ARM processor

Module 1	Teaching Hours
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<p>The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.</p> <p>Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7</p>	10 Hours
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Module 2	
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<p>x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.</p> <p>Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2</p>	10 Hours
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Module 3	
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<p>Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255.</p> <p>Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4</p>	10 Hours
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Module 4	
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<p>Microprocessors versus Microcontrollers, ARM Embedded Systems :The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions</p> <p>Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5</p>	10 Hours
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Module 5	
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<p>Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.</p> <p>Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)</p>	10 Hours
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Course Outcomes: After studying this course, students will be able to

- Differentiate between microprocessors and microcontrollers
- Design and develop assembly language code to solve problems
- Gain the knowledge for interfacing various devices to x86 family and ARM processor
- Demonstrate design of interrupt routines for interfacing devices

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.
 There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

OBJECT ORIENTED CONCEPTS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn fundamental features of object oriented language and JAVA • Set up Java JDK environment to create, debug and run simple Java programs. • Create multi-threaded programs and event handling mechanisms. • Introduce event driven Graphical User Interface (GUI) programming using applets and swings. 			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			10 Hours
Module 2			
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			10 Hours
Module 3			
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			10 Hours
Module 4			
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			10 Hours
Module 5			
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting;			10 Hours

Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using Applets and swings. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Programming Knowledge • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30) 	
Reference Book:	
<ol style="list-style-type: none"> 1. Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 	
Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.	

DATA COMMUNICATION			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data. • Explain with the basics of data communication and various types of computer networks; • Illustrate TCP/IP protocol suite and switching criteria. • Demonstrate Medium Access Control protocols for reliable and noisy channels. • Expose wireless and wired LANs along with IP version. 			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP functions of each layer. • Make out the different types of network devices and their functions within a network 			

- Demonstrate the skills of subnetting and routing mechanisms.

Graduate Attributes

1. Engineering Knowledge
2. Design Development of solution(Partly)
3. Modern Tool Usage
4. Problem Analysis

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Design and implement various algorithms in JAVA • Employ various design strategies for problem solving. • Measure and compare the performance of different algorithms. 			
Description			
Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.			
Experiments			
1	A	Create a Java class called <i>Student</i> with the following details as variables within it. <ul style="list-style-type: none"> (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.	
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.	
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.	
3	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.	
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	
4	Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000 and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.		

5	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.
To generate the data set use random number generator function.
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8.
 - a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
 - b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Learn 80x86 instruction sets and gains the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS51	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the principles of management, organization and entrepreneur. • Discuss on planning, staffing, ERP and their importance • Infer the importance of intellectual property rights and relate the institutional support 			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline 			

their importance in entrepreneurship

- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS52	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstration of application layer protocols • Discuss transport layer services and understand UDP and TCP protocols • Explain routers, IP and Routing Algorithms in network layer • Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard • Illustrate concepts of Multimedia Networking, Security and Network Management 			
Module – 1			Teaching Hours
<p>Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.</p> <p>T1: Chap 2</p>			10 Hours
Module – 2			
<p>Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.</p> <p>T1: Chap 3</p>			10 Hours
Module – 3			
<p>The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,</p>			10 Hours

Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7	
Module – 4	
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	10 Hours
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case studies: : Netflix, You Tube and Kankan. Network Support for Multimedia: Dimensioning Best-Effort Networks, Providing Multiple Classes of Service, Diffserv, Per-Connection Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7: 7.1,7.2,7.5	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Recognize transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard • Describe Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS53	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Provide a strong foundation in database concepts, technology, and practice. • Practice SQL programming through a variety of database problems. • Demonstrate the use of concurrency and transactions in database • Design and build database applications for real world problems. 			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal			10 Hours

Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6	
Module – 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design and build simple database systems • Develop application to interact with databases. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
Reference Books:	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS54	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce core concepts in Automata and Theory of Computation • Identify different Formal language Classes and their Relationships • Design Grammars and Recognizers for different formal languages • Prove or disprove theorems in automata theory using their properties • Determine the decidability and intractability of Computational problems 			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages,			10 Hours

<p>Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012 6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012. 	

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS551	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the concepts involved in Object-Oriented modelling and their benefits. • Demonstrate concept of use-case model, sequence model and state chart model for a given problem. • Explain the facets of the unified process approach to design and build a Software system. • Translate the requirements into implementation for Object Oriented design. • Choose an appropriate design pattern to facilitate development procedure. 			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours

Module – 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Describe the concepts of object-oriented and basic class modelling. • Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. • Choose and apply a befitting design pattern for the given problem. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007. 2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013 	

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS552	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Differentiate the various testing techniques. • Analyze the problem and derive suitable test cases. • Apply suitable technique for designing of flow graph. • Explain the need for planning and monitoring a process. 			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the			8 Hours

process, the quality team. T2: Chapter 17, 20.	
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CS553	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

- Course objectives:** This course will enable students to
- Identify the need for advanced Java concepts like Enumerations and Collections
 - Construct client-server applications using Java socket API
 - Make use of JDBC to access database through Java Programs
 - Adapt servlets to build server side programs
 - Demonstrate the use of JavaBeans to develop component-based Java software

Module – 1

Teaching Hours

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

8 Hours

Module – 2

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

8 Hours

Module – 3

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder

8 Hours

Text Book 1: Ch 15

Module – 4	
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects Text Book 1: Ch 31 Text Book 2: Ch 11	8 Hours
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS554	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain principles of algorithms analysis approaches • Compare and contrast a number theoretic based strategies. • Describe complex signals and data flow in networks • Apply the computational geometry criteria. 			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each			

module.

Text Books:

1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990
2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL57	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.

- Implement, analyze and evaluate networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 80
Part A: 10+25+5 =40
Part B: 10+25+5 =40
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL58	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, <u>Branch_id</u>, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, <u>Branch_id</u>, <u>Card_No</u>, Date_Out, Due_Date) LIBRARY_BRANCH(<u>Branch_id</u>, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average.

	<ol style="list-style-type: none"> 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database:</p> <p>STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database:</p> <p>EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

	<ol style="list-style-type: none"> 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
Part B: Mini project	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Create, Update and query on the database. • Demonstrate the working of different concepts of DBMS • Implement, analyze and evaluate the project developed for an application. 	
Conduction of Practical Examination: <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 30 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 10 + 35 + 5 = 50 Marks b) Part B: Demonstration + Report + Viva voce = 15 + 10 + 05 = 30 Marks 7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS61	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the concepts of Cyber security • Illustrate key management issues and solutions. • Familiarize with Cryptography and very essential algorithms • Introduce cyber Law and ethics to be followed. 			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber			10 Hours

regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Discuss cryptography and its need to various applications • Design and develop simple cryptography algorithms • Understand cyber security and need cyber Law 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015 2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition 3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013 4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning 	

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS62	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain hardware, software and OpenGL Graphics Primitives. • Illustrate interactive computer graphic using the OpenGL. • Design and implementation of algorithms for 2D graphics Primitives and attributes. • Demonstrate Geometric transformations, viewing on both 2D and 3D objects. • Infer the representation of curves, surfaces, Color and Illumination models 			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong			10 Hours

model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3	
Module – 4	
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions. Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14	10 Hours
Module – 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10 Text-2:Chapter 3: 3-1 to 3.11: Input& interaction	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Decide suitable hardware and software for developing graphics packages using OpenGL. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS63	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define System Software such as Assemblers, Loaders, Linkers and Macroprocessors • Familiarize with source file, object file and executable file structures and libraries • Describe the front-end and back-end phases of compiler and their importance to students 			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Utilize lex and yacc tools for implementing different concepts of system software 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS64	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce concepts and terminology used in OS • Explain threading and multithreaded systems • Illustrate process synchronization and concept of Deadlock • Introduce Memory and Virtual memory management, File system and storage techniques 			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			
Secondary Storage Structures, Protection: Mass storage structures; Disk			10 Hours

<p>structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Apply suitable techniques for management of different resources • Use processor, memory, storage and file system commands • Realize the different concepts of OS in platform of usage through case studies 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
<p>Reference Books</p>	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013. 3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS651	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define multi-dimensional data models. • Explain rules related to association, classification and clustering analysis. • Compare and contrast between different classification and clustering algorithms 			
Module – 1			Teaching Hours
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify data mining problems and implement the data warehouse • Write association rules for a given data pattern. • Choose between classification and clustering solution. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS652	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To Learn How to add functionality to designs while minimizing complexity. • What code qualities are required to maintain to keep code flexible? • To Understand the common design patterns. • To explore the appropriate patterns for design problems 			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Be aware of code qualities needed to keep code flexible • Experience core design principles and be able to assess the quality of a design with respect to these principles. • Capable of applying these principles in the design of object oriented systems. • Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. • Be able to select and apply suitable patterns in specific contexts 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS653	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Formulate and solve transportation and assignment problems. • Apply game theory for decision making problems. 			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel’s Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Select and apply optimization techniques for various problems. • Model the given problem as transportation and assignment problem and solve. • Apply game theory for decision support system. 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS654	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain distributed system, their characteristics, challenges and system models. • Describe IPC mechanisms to communicate between distributed objects • Illustrate the operating system support and File Service architecture in a distributed system • Analyze the fundamental concepts, algorithms related to synchronization. 			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern:			
The question paper will have TEN questions.			

There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CSL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use **data input file** where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid **arithmetic expression**. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate **arithmetic expression** involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with **b** preceded by **n a's** using the grammar $a^n b$ (note: input **n** value)
3. Design, develop and implement YACC/C program to construct **Predictive / LL(1) Parsing Table** for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: **abba\$**
4. Design, develop and implement YACC/C program to demonstrate **Shift Reduce Parsing** technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: **id + id * id**.
5. Design, develop and implement a C/Java program to generate the machine code using

Triples for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$

6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the resulting program into a separate file.
b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (C program) file.
7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **20 + 50 + 10 (80)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CSL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes. • Implementation of line drawing and clipping algorithms using OpenGL functions • Design and implementation of algorithms Geometric transformations on both 2D and 3D objects. 			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham's line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic: sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			

Course outcomes: The students should be able to:

- Apply the concepts of computer graphics
- Implement computer graphics applications using OpenGL
- Animate real world problems using OpenGL

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
 - b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M M Raikar, Computer Graphics using OpenGL, Phillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module – 1

Teaching Hours

Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

10 Hours

Module – 2

HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

10 Hours

Module – 3

JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions

10 Hours

Module – 4

PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling

10 Hours

Module – 5

Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.

10 Hours

Course Outcomes: After studying this course, students will be able to

- Adapt HTML and CSS syntax and semantics to build web pages.

- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS72	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe computer architecture. • Measure the performance of architectures in terms of right parameters. • Summarize parallel architecture and the software used for them. 			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder			10 Hours

Buffer, Register Renaming ,Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts of parallel computing and hardware technologies • Compare and contrast the parallel architectures • Illustrate parallel programming concepts 	
<p>Question paper pattern</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013 	

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS73	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module – 1

Teaching Hours

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

10 Hours

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7

Module – 2

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

10 Hours

Text Book1, Sections: 3.1-3.7

Module – 3

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.

08 Hours

Text book 1, Sections: 4.1 – 4.6

Module – 4

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm

10 Hours

Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12

Module – 5

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

12 Hours

Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,

Reinforcement Learning: Introduction, Learning Task, Q Learning

Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3

Course Outcomes:After studying this course, students will be able to

- Identify the problems for machine learning. And select the either supervised,

unsupervised or reinforcement learning.

- Explain theory of probability and statistics related to machine learning
- Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

<p style="text-align: center;">NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII</p>			
Subject Code	15CS741	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn the techniques in natural language processing. • Be familiar with the natural language generation. • Be exposed to Text Mining. • Understand the information retrieval techniques 			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours

Module – 5	
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the natural language text. • Generate the natural language. • Do Text mining. • Apply information retrieval techniques. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008. 2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995. 3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000. 	

CLOUD COMPUTING AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS742	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamentals of cloud computing • Illustrate the cloud application programming and aneka platform • Contrast different cloud platforms used in industry 			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V</p>			8 Hours
Module – 2			8 Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			8 Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix</p>			8 Hours

Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Describe the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS743	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Analyze the cryptographic processes. • Summarize the digital security process. • Indicate the location of a security process in the given system 			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley
2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin
Oxford Scholarship Online: December 2013

Reference Books:

1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS744	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamental design of the unix operating system • Familiarize with the systems calls provided in the unix environment • Design and build an application/service over the unix operating system 			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.			8 Hours

Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Ability to understand and reason out the working of Unix Systems • Build an application/service over a Unix system. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. 2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005. 2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987. 3. Unix Internals - Uresh Vahalia, Pearson Education, 2001. 	

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS751	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Familiarize with the basic concept of soft computing and intelligent systems • Compare with various intelligent systems • Analyze the various soft computing techniques 			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:
1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015
Reference Books:
1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 2011

COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS752	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Review image processing techniques for computer vision • Explain shape and region analysis • Illustrate Hough Transform and its applications to detect lines, circles, ellipses • Contrast three-dimensional image analysis techniques, motion analysis and applications of computer vision algorithms 			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining			8 Hours

Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013. 	

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS753	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the fundamental concepts in image processing • Evaluate techniques followed in image enhancements • Illustrate image segmentation and compression algorithms 			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

Reference Books:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS754	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate storage architectures, • Define backup, recovery, disaster recovery, business continuity, and replication • Examine emerging technologies including IP-SAN • Understand logical and physical components of a storage infrastructure • Identify components of managing and monitoring the data center • Define information security and identify different storage virtualization technologies 			
Module – 1			Teaching Hours
Storage System Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning. Text Book-1 Ch1: 1.2 to 1.4, Ch2: 2.1, 2.3 to 2.5, Ch3: 3.1, 3.3 to 3.5, Ch4: 4.1 and 4.2			8 Hours
Module – 2			
Storage Networking Technologies Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization, Object-Based Storage and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage. Text Book-1 Ch5: 5.3, 5.4, 5.6, 5.9 to 5.11, Ch6: 6.1 to 6.3, Ch7: 7.4, 7.5, 7.7 and 7.9 Ch8: 8.1, 8.2 and 8.4			8 Hours
Module – 3			
Backup, Archive and Replication Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and			8 Hours

Migration in a Virtualized Environment.	
Text Book-1 Ch10: 10.5, 10.8, 10.10 to 10.13, Ch11: 11.1, 11.2, 11.4 and 11.8, Ch12: 12.2, 12.3 and 12.5	
Module – 4	
Cloud Computing and Virtualization Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.	8 Hours
Text Book-1 Ch13: 13.1 to 13.8. Text Book-2 Ch9: 9.1 to 9.5 Ch13: 13.1 to 13.3	
Module – 5	
Securing and Managing Storage Infrastructure Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.	8 Hours
Text Book-1 Ch14: 14.1 to 14.5, Ch15: 15.1 to 15.3, 15.5 and 15.6	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL76	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:
NIL
Course outcomes: The students should be able to:
<ol style="list-style-type: none"> 1. Understand the implementation procedures for the machine learning algorithms. 2. Design Java/Python programs for various Learning algorithms. 3. Apply appropriate data sets to the Machine Learning algorithms. 4. Identify and apply Machine Learning algorithms to solve real world problems.
Conduction of Practical Examination:
<ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script • Marks distribution: Procedure + Conduction + Viva: 20 + 50 +10 (80) <p>Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.</p>

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL77	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Design and develop static and dynamic web pages.
2. Familiarize with Client-Side Programming, Server-Side Programming, Active server Pages.
3. Learn Database Connectivity to web applications.

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.

9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
 - a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
 - b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.I as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

1. In the examination each student picks one question from part A.
2. A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
3. The team must submit a brief project report (15-20 pages) that must include the following
 - a. Introduction
 - b. Requirement Analysis
 - c. Software Requirement Specification
 - d. Analysis and Design
 - e. Implementation
 - f. Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Have a good understanding of Web Application Terminologies, Internet Tools other web services.
- Learn how to link and publish web sites

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.

2. Mini project has to be evaluated for 30 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: $10 + 35 + 5 = 50$ Marks
 - b) Part B: Demonstration + Report + Viva voce = $15 + 10 + 05 = 30$ Marks

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

INTERNET OF THINGS TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Assess the genesis and impact of IoT applications, architectures in real world. • Illustrate diverse methods of deploying smart objects and connect them to network. • Compare different Application protocols for IoT. • Infer the role of Data Analytics and Security in IoT. • Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry. 			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,			10 Hours

Smart City Security Architecture, Smart City Use-Case Examples.	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. • Appraise the role of IoT protocols for efficient network communication. • Elaborate the need for Data Analytics and Security in IoT. • Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) 2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017 	
Reference Books:	
<ol style="list-style-type: none"> 1. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands -on- Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) 2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224) 	

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand Hadoop Distributed File system and examine MapReduce Programming • Explore Hadoop tools and manage Hadoop with Ambari • Appraise the role of Business intelligence and its applications across industries • Assess core data mining techniques for data analytics • Identify various Text Mining techniques 			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Master the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			

2. Anil Maheshwari, "**Data Analytics**", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180

Reference Books:

- 1) Tom White, "**Hadoop: The Definitive Guide**", 4th Edition, O'Reilly Media,
- 2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "**Professional Hadoop Solutions**", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

**HIGH PERFORMANCE COMPUTING [As
per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CS831	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

Module – 1

Teaching Hours

Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)

10 Hours

Module – 2

High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built

10 Hours

Module – 3

Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques

10 Hours

Module – 4

Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)

10 Hours

Module – 5

Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks

10 Hours

Course outcomes: The students should be able to:

- Illustrate the key factors affecting performance of CSE applications, and
- Make mapping of applications to high-performance computing systems, and

- Apply hardware/software co-design for achieving performance on real-world applications

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

MODERN INTERFACE DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS832	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
<ul style="list-style-type: none"> • Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002. 			

Reference Books:

3. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
4. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – VIII			
Subject Code	15CS833	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To understand the need for interoperable network management. • To learn to the concepts and architecture behind standards based network management. • To understand the concepts and terminology associated with SNMP and TMN • To understand network management as a typical distributed application 			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			8 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			
Module – 3			8 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			
Module – 4			8 Hours
Broadband Access Networks, Broadband Access Technology; HFCT			

<p>Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles</p>	
<p>Module – 5</p>	
<p>Network Management Applications: Configuration Management- Network 8 Hours Provisioning, Inventory Management, Network Topology, Fault Management-Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p>	
<p>1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books:</p>	
<p>1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

SYSTEM MODELLING AND SIMULATION
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	15CS834	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module – 1

Teaching Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software:** Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

10 Hours

Module – 2

Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.

Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont..., Steady-state behavior of M /G/1 queue, Networks of queues,

10 Hours

Module – 3

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique.

10 Hours

Module – 4

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.

Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Contd..**

10 Hours

Module – 5

Measures of performance and their estimation, Output analysis for terminating simulations Continued..., Output analysis for steady-state simulations.

Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of

10 Hours

simulation models, Calibration and validation of models, Optimization via Simulation.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the system concept and apply functional modeling method to model the activities of a static system • Describe the behavior of a dynamic system and create an analogous model for a dynamic system; • Simulate the operation of a dynamic system and make improvement according to the simulation results. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007 	

INTERNSHIP / PROFESSIONAL PRACTISE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII

Subject Code	15CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Evaluation of Internship :

**PROJECT WORK PHASE II [As per Choice Based Credit System
(CBCS) scheme] (Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 05

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Conduction of Practical Examination:

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – VIII

Subject Code	15CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 02

Course objectives: This course will enable students to

•

Description:

•

Course outcomes: The students should be able to:

•

Evaluation of seminar:

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT31	Engineering Mathematics - III	04	--	03	80	20	100	4
2	15CS32	Analog and Digital Electronics	04	--	03	80	20	100	4
3	15CS33	Data Structures and Applications	04	--	03	80	20	100	4
4	15CS34	Computer Organization	04	--	03	80	20	100	4
5	15CS35	Unix and Shell Programming	04	--	03	80	20	100	4
6	15CS36	Discrete Mathematical Structures	04	--	03	80	20	100	4
7	15CSL37	Analog and Digital Electronics Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL38	Data Structures Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT41	Engineering Mathematics - IV	04	--	03	80	20	100	4
2	15CS 42	Software Engineering	04	--	03	80	20	100	4
3	15CS43	Design and Analysis of Algorithms	04	--	03	80	20	100	4
4	15CS 44	Microprocessors and Microcontrollers	04	--	03	80	20	100	4
5	15CS45	Object Oriented Concepts	04	--	03	80	20	100	4
6	15CS46	Data Communication	04	--	03	80	20	100	4
7	15CSL47	Design and Analysis of Algorithm Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL48	Microprocessors Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS51	Management and Entrepreneurship for IT Industry	04	--	03	80	20	100	4
2	15CS52	Computer Networks	04	--	03	80	20	100	4
3	15CS53	Database Management System	04	--	03	80	20	100	4
4	15CS54	Automata theory and Computability	04	--	03	80	20	100	4
5	15CS55x	Professional Elective 1	03	--	03	80	20	100	3
6	15CS56x	Open Elective 1	03	--	03	80	20	100	3
7	15CSL57	Computer Network Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL58	DBMS Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 1		Open Elective	
15CS553	Advanced JAVA and J2EE	15CS564	Dot Net framework for application development;

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

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B.E. Computer Science & Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS61	Cryptography, Network Security and Cyber Law	04	--	03	80	20	100	4
2	15CS62	Computer Graphics and Visualization	04	--	03	80	20	100	4
3	15CS63	System Software and Compiler Design	04	--	03	80	20	100	4
4	15CS64	Operating Systems	04	--	03	80	20	100	4
5	15CS65x	Professional Elective 2	03	--	03	80	20	100	3
6	15CS66x	Open Elective 2	03	--	03	80	20	100	3
7	15CSL67	System Software and Operating System Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL68	Computer Graphics Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 2		Open elective	
15CS651	Data Mining and Data Warehousing	15CS664	Python Application Programming

- Professional Elective: Electives relevant to chosen specialization / branch**
- Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS71	Web Technology and its applications	04	--	03	20	80	100	4
2	15CS72	Advanced Computer Architectures	04	--	03	20	80	100	4
3	15CS73	Machine Learning	04	--	03	20	80	100	4
4	15CS74x	Professional Elective 3	03	--	03	20	80	100	3
5	15CS75x	Professional Elective 4	03	--	03	20	80	100	3
6	15CSL76	Machine Learning Laboratory	--	1I+2P	03	20	80	100	2
7	15CSL77	Web Technology Laboratory with mini project	--	1I+2P	03	20	80	100	2
8	15CSP78	Project Phase 1 + Seminar	--	--	--	100	--	100	2
TOTAL			18	6	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CS742	Cloud Computing and its Applications	15CS754	Storage Area Networks

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Project Phase 1 + Seminar : Literature Survey, Problem Identification, Objectives and Methodology, Submission of Synopsis and Seminar

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering
 VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS81	Internet of Things and Applications	4	--	3	20	80	100	4
2	15CS82	Big Data Analytics	4	--	3	20	80	100	4
3	15CS83x	Professional Elective 5	3	--	3	20	80	100	3
4	15CS84	Internship / Professional Practice	Industry Oriented		3	50	50	100	2
5	15CSP85	Project work phase II	--	6	3	100	100	200	5
6	15CSS86	Seminar	--	4	--	100	--	100	2
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CS834	System Modeling and Simulation

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Internship / Professional Practice: To be carried out between 6th and 7th semester vacation or 7th and 8th semester vacation period

ENGINEERING MATHEMATICS-III

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Comprehend and use of analytical and numerical methods in different engineering fields • Apprehend and apply Fourier Series • Realize and use of Fourier transforms and Z-Transforms • Use of statistical methods in curve fitting applications • Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation 			
Module -1			Teaching Hours
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of Periodic functions with period 2π and with arbitrary period $2c$, Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis. Complex Fourier series</p>			10Hours
Module -2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse transform. Z-transform: Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.</p>			10 Hours
Module – 3			
<p>Statistical Methods: Correlation and rank Correlation coefficients, Regression and Regression coefficients, lines of regression - problems Curve fitting: Curve fitting by the method of least squares, Fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}, y = ax^b$. Numerical Methods: Numerical solution of algebraic and transcendental equations by: Regular-falsi method, Secant method, Newton - Raphson method and Graphical method.</p>			10 Hours
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula. Central Difference-Stirling's and Bessel's formulae (all formulae without proof)-Problems. Numerical integration: Simpson's 1/3, 3/8 rule, Weddle's rule (without proof) -Problems</p>			10 Hours

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem (without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, minimal surface of revolution, hanging chain, problems</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> • Use of periodic signals and Fourier series to analyze circuits • Explain the general linear system theory for continuous-time signals and systems using the Fourier Transform • Analyze discrete-time systems using convolution and the z-transform • Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral • Use curl and divergence of a vector function in three dimensions, as well as apply the Green's Theorem, Divergence Theorem and Stokes' theorem in various applications • Solve the simple problem of the calculus of variations 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 4. Conduct Investigations of Complex Problems 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013. 2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 	
Reference Books:	
<ol style="list-style-type: none"> 1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley. 3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed. 	

ANALOG AND DIGITAL ELECTRONICS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable the students to

- Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT
- Evolve and Analyze Operational Amplifier circuits and their applications
- Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.
- Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.
- Describe, Design and Analyze Synchronous and Asynchronous Sequential
- Explain and design registers and Counters, A/D and D/A converters.

Module -1

Teaching Hours

Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. **Introduction to Operational Amplifier:** Ideal v/s practical Opamp, Performance Parameters, **Operational Amplifier Application Circuits:** Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter.
Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)

10 Hours

Module -2

The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. **Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.
Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.

10 Hours

Module – 3

<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>	10 Hours
Module-4	
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>	10 Hours
Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
Course outcomes: After Studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions(partly) 3. Modern Tool Usage 4. Problem Analysis 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

DATA STRUCTURES AND APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Illustrate linear representation of data structures: Stack, Queues, Lists • Illustrate linear representation of data structures: Trees, Graphs • Demonstrate sorting and searching algorithms • Find suitable data structure during application development/Problem Solving 			
Module -1			Teaching Hours
<p>Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4</p>			10 Hours
Module -2			
<p>Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13</p>			10 Hours
Module – 3			

<p>Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples</p> <p>Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10</p>	10 Hours
Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7 Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Use different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Use stack, Queue, Lists, Trees and Graphs in problem solving • Implement all data structures in a high-level language for problem solving. 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions 3. Conduct Investigations of Complex Problems 4. Problem Analysis for suitability of data structures. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	

Text Books:

1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014
2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014

Reference Books:

1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning, 2014
2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012
3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013
4. Data Structures using C - A M Tenenbaum, PHI, 1989
5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives:			
This course will enable the students to			
<ul style="list-style-type: none"> • Explain the basic sub systems of a computer, their organization, structure and operation. • Illustrate the concept of programs as sequences of machine instructions. • Demonstrate different ways of communicating with I/O devices and standard I/O interfaces. • Describe memory hierarchy and concept of virtual memory. • Describe arithmetic and logical operations with integer and floating-point operands. • Illustrate organization of a simple processor, pipelined processor and other computing systems. 			
Module -1			Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions			10Hours
Module -2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.			10 Hours
Module – 3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.			10 Hours
Module-4			
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.			10 Hours
Module-5			

<p>Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.</p>	<p>10 Hours</p>
<p>Course outcomes: After studying this course, students will be able to:</p>	
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Design and analyse simple arithmetic and logical units. 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12) 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 	

UNIX AND SHELL PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Illustrate the UNIX system architecture and use of basic Commands. • Use of editors and networking commands. • Demonstrate writing shell scripts. • Categorize, compare and make use of UNIX system calls. 			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			10Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			10Hours

Module – 3	
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>	10Hours
Module-4	
<p>Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.</p> <p>Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2</p>	10Hours
Module-5	
<p>Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.</p> <p>Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.</p> <p>Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1</p>	10Hours
Course outcomes:	

After studying this course, students will be able to:

- Explain UNIX system and use different commands.
- Write Shell scripts for certain functions on different subsystems.
- Demonstrate use of editors and Perl script writing

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Environment and Sustainability
3. Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition , Wiley,2014.

DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Provide theoretical foundations of computer science to perceive other courses in the programme. • Illustrate applications of discrete structures: logic, relations, functions, set theory and counting. • Describe different mathematical proof techniques, • Illustrate the use of graph theory in computer science. 			
Module -1			Teaching Hours
<p>Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,</p>			10Hours
Module -2			
<p>Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.</p>			10 Hours
Module – 3			
<p>Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.</p>			10 Hours
Module-4			
<p>The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,</p>			10 Hours
Module-5			
<p>Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes</p>			10 Hours

<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Application of different mathematical proofs techniques in proving theorems in the courses. • Compare graphs, trees and their applications.
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Conduct Investigations of Complex Problems 4. Design/Development of Solutions.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007. 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010. 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004. 5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER - III

Laboratory Code	15CSL37	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enable students to get practical experience in design, assembly and evaluation/testing of

- Analog components and circuits including Operational Amplifier, Timer, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and registers using flip-flops.
- Synchronous and Asynchronous sequential circuits.
- A/D and D/A converters

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 20 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

Continued:

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

Study experiment

12. To study 4-bit ALU using IC-74181.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
- Design and demonstrate various combinational logic circuits.
- Design and demonstrate various types of counters and Registers using Flip-flops
- Use simulation package to design circuits.
- Understand the working and implementation of ALU.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Modern Tool Usage

Conduction of Practical Examination:

1. All laboratory experiments (1 to 11 nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script.
4. Marks distribution:
 - a) For questions having part a only- Procedure + Conduction + Viva: **20 + 50 + 10 = 80 Marks**
 - b) For questions having part a and b
 - Part a- Procedure + Conduction + Viva: **10 + 35 + 05 = 50 Marks**
 - Part b- Procedure + Conduction + Viva: **10 + 15 + 05 = 30 Marks**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

DATA STRUCTURES LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Laboratory Code	15CSL38	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 02

Course objectives:

This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Asymptotic performance of algorithms.
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs
- Sorting and searching algorithms

Descriptions (if any)

Implement all the experiments in C Language under Linux / Windows environment.

Laboratory Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following **Array** operations
 - a. Creating an Array of N Integer Elements
 - b. Display of Array Elements with Suitable Headings
 - c. Inserting an Element (**ELEM**) at a given valid Position (**POS**)
 - d. Deleting an Element at a given valid Position(**POS**)
 - e. Exit.Support the program with functions for each of the above operations.
2. Design, Develop and Implement a Program in C for the following operations on **Strings**
 - a. Read a main String (**STR**), a Pattern String (**PAT**) and a Replace String (**REP**)
 - b. Perform Pattern Matching Operation: Find and Replace all occurrences of **PAT** in **STR** with **REP** if **PAT** exists in **STR**. Report suitable messages in case **PAT** does not exist in **STR**Support the program with functions for each of the above operations. Don't use Built-in functions.
3. Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
 - a. **Push** an Element on to Stack
 - b. **Pop** an Element from Stack
 - c. Demonstrate how Stack can be used to check **Palindrome**
 - d. Demonstrate **Overflow** and **Underflow** situations on Stack
 - e. Display the status of Stack

f. Exit

Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(**Remainder**), ^(Power) and **alphanumeric** operands.
5. Design, Develop and Implement a Program in C for the following Stack Applications
 - a. Evaluation of **Suffix expression** with single digit operands and operators: +, -, *, /, %, ^
 - b. Solving **Tower of Hanoi** problem with **n** disks
6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
 - a. Insert an Element on to Circular QUEUE
 - b. Delete an Element from Circular QUEUE
 - c. Demonstrate **Overflow** and **Underflow** situations on Circular QUEUE
 - d. Display the status of Circular QUEUE
 - e. Exit

Support the program with appropriate functions for each of the above operations

Continued:

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: **USN, Name, Branch, Sem, PhNo**
 - a. Create a **SLL** of **N** Students Data by using **front insertion**.
 - b. Display the status of **SLL** and count the number of nodes in it
 - c. Perform Insertion / Deletion at End of **SLL**
 - d. Perform Insertion / Deletion at Front of **SLL(Demonstration of stack)**
 - e. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: **SSN, Name, Dept, Designation, Sal, PhNo**
 - a. Create a **DLL** of **N** Employees Data by using **end insertion**.
 - b. Display the status of **DLL** and count the number of nodes in it
 - c. Perform Insertion and Deletion at End of **DLL**
 - d. Perform Insertion and Deletion at Front of **DLL**
 - e. Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - f. Exit

<p>9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) <p>Support the program with appropriate functions for each of the above operations</p> <p>10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers</p> <ol style="list-style-type: none"> Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message Exit <p>11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method <p>12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K → L as $H(K) = K \bmod m$ (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Analyze and Compare various linear and non-linear data structures Code, debug and demonstrate the working nature of different types of data structures and their applications Implement, analyze and evaluate the searching and sorting algorithms Choose the appropriate data structure for solving real world problems
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> Engineering Knowledge Problem Analysis Design/Development of Solutions Modern Tool Usage
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments (TWELVE nos) are to be included for practical examination. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80) Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate, solve and analyze engineering problems. • Apply numerical methods to solve ordinary differential equations. • Apply finite difference method to solve partial differential equations. • Perform complex analysis. • Interpret use of sampling theory. • Apply joint probability distribution and stochastic process. 			
Module 1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Picard’s method, Taylor’s series method, modified Euler’s method, Runge-Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard’s method, Runge-Kutta method of fourth order			10 Hours
Module 2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Picard’s method, Runge-Kutta method and Milne’s method. Special Functions: Bessel’s functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre’s functions - Legendre’s polynomial, Rodrigue’s formula, problems.			10 Hours
Module 3			
Complex Variables: Function of a complex variable, limits, continuity, differentiability,. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem with proof and problems. Transformations: Conformal transformations, discussion of transformations: $w = z + iy$, $w = z^2$, $w = z + (1/z)$ and bilinear transformations.			10 Hours
Module 4			
Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.			10 Hours
Module 5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.			10 Hours

<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use appropriate numerical methods to solve first and second order ordinary differential equations. • Use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction. • State and prove Cauchy's theorem and its consequences including Cauchy's integral formula. • Compute residues and apply the residue theorem to evaluate integrals. • Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods.
<p>Graduate Attributes</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-Long Learning • Conduct Investigations of Complex Problems
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013. 3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

SOFTWARE ENGINEERING			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Outline software engineering principles and activities involved in building large software programs. • Identify ethical and professional issues and explain why they are of concern to software engineers. • Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. • Differentiate system models, use UML diagrams and apply design patterns. • Discuss the distinctions between validation testing and defect testing. • Recognize the importance of software maintenance and describe the intricacies involved in software evolution. • Apply estimation techniques, schedule project activities and compute pricing. • Identify software quality parameters and quantify software using measurements and metrics. • List software quality standards and outline the practices involved. • Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility. 			
Module 1			Teaching Hours
<p>Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.</p> <p>Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities.</p> <p>Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).</p>			12 Hours
Module 2			
<p>System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5).</p> <p>Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-Oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).</p>			11 Hours
Module 3			
<p>Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695).</p> <p>Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).</p>			9 Hours

Module 4	
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)	10 Hours
Module 5	
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “ The SCRUM Primer, Ver 2.0 ”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):	8 Hours
Course Outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Use the techniques, skills, and modern engineering tools necessary for engineering practice • Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Project Management and Finance • Conduct Investigations of Complex Problems • Modern Tool Usage • Ethics 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24) 2. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf 	
Reference Books:	
<ol style="list-style-type: none"> 1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India 	
Web Reference for eBooks on Agile:	
<ol style="list-style-type: none"> 1. http://agilemanifesto.org/ 2. http://www.jamesshore.com/Agile-Book/ 	

DESIGN AND ANALYSIS OF ALGORITHMS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain various computational problem solving techniques. • Apply appropriate method to solve a given problem. • Describe various methods of algorithm analysis. 			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen’s matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim’s Algorithm, Kruskal’s Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall’s Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic			10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education) 	

MICROPROCESSORS AND MICROCONTROLLERS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Make familiar with importance and applications of microprocessors and microcontrollers
- Expose architecture of 8086 microprocessor and ARM processor
- Familiarize instruction set of ARM processor

Module 1	Teaching Hours
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<p>The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.</p> <p>Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7</p>	10 Hours
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Module 2	Teaching Hours
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<p>x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.</p> <p>Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2</p>	10 Hours
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Module 3	Teaching Hours
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<p>Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255.</p> <p>Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4</p>	10 Hours
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Module 4	Teaching Hours
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<p>Microprocessors versus Microcontrollers, ARM Embedded Systems :The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions</p> <p>Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5</p>	10 Hours
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Module 5	Teaching Hours
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<p>Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.</p> <p>Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)</p>	10 Hours
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Course Outcomes: After studying this course, students will be able to

- Differentiate between microprocessors and microcontrollers
- Design and develop assembly language code to solve problems
- Gain the knowledge for interfacing various devices to x86 family and ARM processor
- Demonstrate design of interrupt routines for interfacing devices

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.
 There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

OBJECT ORIENTED CONCEPTS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Learn fundamental features of object oriented language and JAVA • Set up Java JDK environment to create, debug and run simple Java programs. • Create multi-threaded programs and event handling mechanisms. • Introduce event driven Graphical User Interface (GUI) programming using applets and swings. 			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			10 Hours
Module 2			
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			10 Hours
Module 3			
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			10 Hours
Module 4			
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			10 Hours
Module 5			
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting;			10 Hours

Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using Applets and swings. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Programming Knowledge • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30) 	
Reference Book:	
<ol style="list-style-type: none"> 1. Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 	
Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.	

DATA COMMUNICATION			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data. • Explain with the basics of data communication and various types of computer networks; • Illustrate TCP/IP protocol suite and switching criteria. • Demonstrate Medium Access Control protocols for reliable and noisy channels. • Expose wireless and wired LANs along with IP version. 			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP functions of each layer. • Make out the different types of network devices and their functions within a network 			

- Demonstrate the skills of subnetting and routing mechanisms.

Graduate Attributes

1. Engineering Knowledge
2. Design Development of solution(Partly)
3. Modern Tool Usage
4. Problem Analysis

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Design and implement various algorithms in JAVA • Employ various design strategies for problem solving. • Measure and compare the performance of different algorithms. 			
Description			
Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.			
Experiments			
1	A	Create a Java class called <i>Student</i> with the following details as variables within it. <ul style="list-style-type: none"> (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.	
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.	
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.	
3	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.	
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	
4	Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000 and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.		

5	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.
To generate the data set use random number generator function.
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8.
 - a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
 - b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Learn 80x86 instruction sets and gains the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS51	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the principles of management, organization and entrepreneur. • Discuss on planning, staffing, ERP and their importance • Infer the importance of intellectual property rights and relate the institutional support 			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline 			

their importance in entrepreneurship

- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS52	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstration of application layer protocols • Discuss transport layer services and understand UDP and TCP protocols • Explain routers, IP and Routing Algorithms in network layer • Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard • Illustrate concepts of Multimedia Networking, Security and Network Management 			
Module – 1			Teaching Hours
<p>Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.</p> <p>T1: Chap 2</p>			10 Hours
Module – 2			
<p>Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.</p> <p>T1: Chap 3</p>			10 Hours
Module – 3			
<p>The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,</p>			10 Hours

Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7	
Module – 4	
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	10 Hours
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case studies: : Netflix, You Tube and Kankan. Network Support for Multimedia: Dimensioning Best-Effort Networks, Providing Multiple Classes of Service, Diffserv, Per-Connection Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7: 7.1,7.2,7.5	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Recognize transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard • Describe Multimedia Networking and Network Management 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
<ol style="list-style-type: none"> 1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning 	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS53	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Provide a strong foundation in database concepts, technology, and practice. • Practice SQL programming through a variety of database problems. • Demonstrate the use of concurrency and transactions in database • Design and build database applications for real world problems. 			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal			10 Hours

<p>Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms</p> <p>Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6</p>	
<p>Module – 5</p>	
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures</p> <p>Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.</p>	<p>10 Hours</p>
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design and build simple database systems • Develop application to interact with databases. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS54	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce core concepts in Automata and Theory of Computation • Identify different Formal language Classes and their Relationships • Design Grammars and Recognizers for different formal languages • Prove or disprove theorems in automata theory using their properties • Determine the decidability and intractability of Computational problems 			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages,			10 Hours

<p>Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012 6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012. 	

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS551	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the concepts involved in Object-Oriented modelling and their benefits. • Demonstrate concept of use-case model, sequence model and state chart model for a given problem. • Explain the facets of the unified process approach to design and build a Software system. • Translate the requirements into implementation for Object Oriented design. • Choose an appropriate design pattern to facilitate development procedure. 			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours

Module – 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Describe the concepts of object-oriented and basic class modelling. • Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. • Choose and apply a befitting design pattern for the given problem. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007. 2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013 	

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS552	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Differentiate the various testing techniques. • Analyze the problem and derive suitable test cases. • Apply suitable technique for designing of flow graph. • Explain the need for planning and monitoring a process. 			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the			8 Hours

process, the quality team. T2: Chapter 17, 20.	
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CS553	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

- Course objectives:** This course will enable students to
- Identify the need for advanced Java concepts like Enumerations and Collections
 - Construct client-server applications using Java socket API
 - Make use of JDBC to access database through Java Programs
 - Adapt servlets to build server side programs
 - Demonstrate the use of JavaBeans to develop component-based Java software

Module – 1

Teaching Hours

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

8 Hours

Module – 2

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

8 Hours

Module – 3

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder

8 Hours

Text Book 1: Ch 15

Module – 4	
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects Text Book 1: Ch 31 Text Book 2: Ch 11	8 Hours
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS554	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain principles of algorithms analysis approaches • Compare and contrast a number theoretic based strategies. • Describe complex signals and data flow in networks • Apply the computational geometry criteria. 			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each			

module.

Text Books:

1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990
2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL57	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.

- Implement, analyze and evaluate networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 80
Part A: 10+25+5 =40
Part B: 10+25+5 =40
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL58	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, <u>Branch_id</u>, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, <u>Branch_id</u>, <u>Card_No</u>, Date_Out, Due_Date) LIBRARY_BRANCH(<u>Branch_id</u>, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average.

	<ol style="list-style-type: none"> 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database:</p> <p>STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database:</p> <p>EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

	<ol style="list-style-type: none"> 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
<p>Part B: Mini project</p>	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Create, Update and query on the database. • Demonstrate the working of different concepts of DBMS • Implement, analyze and evaluate the project developed for an application. 	
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 30 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 10 + 35 + 5 = 50 Marks b) Part B: Demonstration + Report + Viva voce = 15 + 10 + 05 = 30 Marks 7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS61	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the concepts of Cyber security • Illustrate key management issues and solutions. • Familiarize with Cryptography and very essential algorithms • Introduce cyber Law and ethics to be followed. 			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber			10 Hours

regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Discuss cryptography and its need to various applications • Design and develop simple cryptography algorithms • Understand cyber security and need cyber Law 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015 2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition 3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013 4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning 	

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS62	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain hardware, software and OpenGL Graphics Primitives. • Illustrate interactive computer graphic using the OpenGL. • Design and implementation of algorithms for 2D graphics Primitives and attributes. • Demonstrate Geometric transformations, viewing on both 2D and 3D objects. • Infer the representation of curves, surfaces, Color and Illumination models 			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong			10 Hours

model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3	
Module – 4	
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions. Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14	10 Hours
Module – 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10 Text-2:Chapter 3: 3-1 to 3.11: Input& interaction	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Decide suitable hardware and software for developing graphics packages using OpenGL. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS63	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define System Software such as Assemblers, Loaders, Linkers and Macroprocessors • Familiarize with source file, object file and executable file structures and libraries • Describe the front-end and back-end phases of compiler and their importance to students 			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Utilize lex and yacc tools for implementing different concepts of system software 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS64	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce concepts and terminology used in OS • Explain threading and multithreaded systems • Illustrate process synchronization and concept of Deadlock • Introduce Memory and Virtual memory management, File system and storage techniques 			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			
Secondary Storage Structures, Protection: Mass storage structures; Disk			10 Hours

<p>structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Apply suitable techniques for management of different resources • Use processor, memory, storage and file system commands • Realize the different concepts of OS in platform of usage through case studies 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
<p>Reference Books</p>	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013. 3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS651	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define multi-dimensional data models. • Explain rules related to association, classification and clustering analysis. • Compare and contrast between different classification and clustering algorithms 			
Module – 1			Teaching Hours
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify data mining problems and implement the data warehouse • Write association rules for a given data pattern. • Choose between classification and clustering solution. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS652	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To Learn How to add functionality to designs while minimizing complexity. • What code qualities are required to maintain to keep code flexible? • To Understand the common design patterns. • To explore the appropriate patterns for design problems 			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Be aware of code qualities needed to keep code flexible • Experience core design principles and be able to assess the quality of a design with respect to these principles. • Capable of applying these principles in the design of object oriented systems. • Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. • Be able to select and apply suitable patterns in specific contexts 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS653	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Formulate and solve transportation and assignment problems. • Apply game theory for decision making problems. 			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel’s Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Select and apply optimization techniques for various problems. • Model the given problem as transportation and assignment problem and solve. • Apply game theory for decision support system. 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS654	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain distributed system, their characteristics, challenges and system models. • Describe IPC mechanisms to communicate between distributed objects • Illustrate the operating system support and File Service architecture in a distributed system • Analyze the fundamental concepts, algorithms related to synchronization. 			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern: The question paper will have TEN questions.			

There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CSL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use **data input file** where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid **arithmetic expression**. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate **arithmetic expression** involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with **b** preceded by **n a's** using the grammar $a^n b$ (note: input **n** value)
3. Design, develop and implement YACC/C program to construct **Predictive / LL(1) Parsing Table** for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: **abba\$**
4. Design, develop and implement YACC/C program to demonstrate **Shift Reduce Parsing** technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: **id + id * id**.
5. Design, develop and implement a C/Java program to generate the machine code using

Triples for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$

6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the resulting program into a separate file.
b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (C program) file.
7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **20 + 50 + 10 (80)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CSL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes. • Implementation of line drawing and clipping algorithms using OpenGL functions • Design and implementation of algorithms Geometric transformations on both 2D and 3D objects. 			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham’s line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic: sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			

Course outcomes: The students should be able to:

- Apply the concepts of computer graphics
- Implement computer graphics applications using OpenGL
- Animate real world problems using OpenGL

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
 - b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M M Raikar, Computer Graphics using OpenGL, Phillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Illustrate the Semantic Structure of HTML and CSS • Compose forms and tables using HTML and CSS • Design Client-Side programs using JavaScript and Server-Side programs using PHP • Infer Object Oriented Programming capabilities of PHP • Examine JavaScript frameworks such as jQuery and Backbone 			
Module – 1			Teaching Hours
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.			10 Hours
Module – 2			
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.			10 Hours
Module – 3			
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions			10 Hours
Module – 4			
PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling			10 Hours
Module – 5			
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Adapt HTML and CSS syntax and semantics to build web pages. 			

- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS72	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe computer architecture. • Measure the performance of architectures in terms of right parameters. • Summarize parallel architecture and the software used for them. 			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder			10 Hours

Buffer, Register Renaming ,Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts of parallel computing and hardware technologies • Compare and contrast the parallel architectures • Illustrate parallel programming concepts 	
<p>Question paper pattern</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013 	

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS73	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module – 1

Teaching Hours

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

10 Hours

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7

Module – 2

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

10 Hours

Text Book1, Sections: 3.1-3.7

Module – 3

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.

08 Hours

Text book 1, Sections: 4.1 – 4.6

Module – 4

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm

10 Hours

Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12

Module – 5

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

12 Hours

Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,

Reinforcement Learning: Introduction, Learning Task, Q Learning

Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3

Course Outcomes:After studying this course, students will be able to

- Identify the problems for machine learning. And select the either supervised,

unsupervised or reinforcement learning.

- Explain theory of probability and statistics related to machine learning
- Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

<p style="text-align: center;">NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII</p>			
Subject Code	15CS741	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn the techniques in natural language processing. • Be familiar with the natural language generation. • Be exposed to Text Mining. • Understand the information retrieval techniques 			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours

Module – 5	
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the natural language text. • Generate the natural language. • Do Text mining. • Apply information retrieval techniques. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008. 2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995. 3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000. 	

CLOUD COMPUTING AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS742	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamentals of cloud computing • Illustrate the cloud application programming and aneka platform • Contrast different cloud platforms used in industry 			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V</p>			8 Hours
Module – 2			8 Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			8 Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix</p>			8 Hours

Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Describe the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS743	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Analyze the cryptographic processes. • Summarize the digital security process. • Indicate the location of a security process in the given system 			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley
2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin
Oxford Scholarship Online: December 2013

Reference Books:

1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS744	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamental design of the unix operating system • Familiarize with the systems calls provided in the unix environment • Design and build an application/service over the unix operating system 			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.			8 Hours

Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Ability to understand and reason out the working of Unix Systems • Build an application/service over a Unix system. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. 2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005. 2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987. 3. Unix Internals - Uresh Vahalia, Pearson Education, 2001. 	

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS751	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Familiarize with the basic concept of soft computing and intelligent systems • Compare with various intelligent systems • Analyze the various soft computing techniques 			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:
1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015
Reference Books:
1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 2011

COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS752	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Review image processing techniques for computer vision • Explain shape and region analysis • Illustrate Hough Transform and its applications to detect lines, circles, ellipses • Contrast three-dimensional image analysis techniques, motion analysis and applications of computer vision algorithms 			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining			8 Hours

Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013. 	

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS753	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the fundamental concepts in image processing • Evaluate techniques followed in image enhancements • Illustrate image segmentation and compression algorithms 			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

Reference Books:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS754	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate storage architectures, • Define backup, recovery, disaster recovery, business continuity, and replication • Examine emerging technologies including IP-SAN • Understand logical and physical components of a storage infrastructure • Identify components of managing and monitoring the data center • Define information security and identify different storage virtualization technologies 			
Module – 1			Teaching Hours
Storage System Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning. Text Book-1 Ch1: 1.2 to 1.4, Ch2: 2.1, 2.3 to 2.5, Ch3: 3.1, 3.3 to 3.5, Ch4: 4.1 and 4.2			8 Hours
Module – 2			
Storage Networking Technologies Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization, Object-Based Storage and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage. Text Book-1 Ch5: 5.3, 5.4, 5.6, 5.9 to 5.11, Ch6: 6.1 to 6.3, Ch7: 7.4, 7.5, 7.7 and 7.9 Ch8: 8.1, 8.2 and 8.4			8 Hours
Module – 3			
Backup, Archive and Replication Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and			8 Hours

Migration in a Virtualized Environment.	
Text Book-1 Ch10: 10.5, 10.8, 10.10 to 10.13, Ch11: 11.1, 11.2, 11.4 and 11.8, Ch12: 12.2, 12.3 and 12.5	
Module – 4	
Cloud Computing and Virtualization Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.	8 Hours
Text Book-1 Ch13: 13.1 to 13.8. Text Book-2 Ch9: 9.1 to 9.5 Ch13: 13.1 to 13.3	
Module – 5	
Securing and Managing Storage Infrastructure Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.	8 Hours
Text Book-1 Ch14: 14.1 to 14.5, Ch15: 15.1 to 15.3, 15.5 and 15.6	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL76	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:
NIL
Course outcomes: The students should be able to:
<ol style="list-style-type: none"> 1. Understand the implementation procedures for the machine learning algorithms. 2. Design Java/Python programs for various Learning algorithms. 3. Apply appropriate data sets to the Machine Learning algorithms. 4. Identify and apply Machine Learning algorithms to solve real world problems.
Conduction of Practical Examination:
<ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script • Marks distribution: Procedure + Conduction + Viva: 20 + 50 +10 (80) <p>Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.</p>

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL77	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Design and develop static and dynamic web pages.
2. Familiarize with Client-Side Programming, Server-Side Programming, Active server Pages.
3. Learn Database Connectivity to web applications.

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.

9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
 - a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
 - b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.I as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

1. In the examination each student picks one question from part A.
2. A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
3. The team must submit a brief project report (15-20 pages) that must include the following
 - a. Introduction
 - b. Requirement Analysis
 - c. Software Requirement Specification
 - d. Analysis and Design
 - e. Implementation
 - f. Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Have a good understanding of Web Application Terminologies, Internet Tools other web services.
- Learn how to link and publish web sites

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.

2. Mini project has to be evaluated for 30 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: $10 + 35 + 5 = 50$ Marks
 - b) Part B: Demonstration + Report + Viva voce = $15 + 10 + 05 = 30$ Marks

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

INTERNET OF THINGS TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Assess the genesis and impact of IoT applications, architectures in real world. • Illustrate diverse methods of deploying smart objects and connect them to network. • Compare different Application protocols for IoT. • Infer the role of Data Analytics and Security in IoT. • Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry. 			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,			10 Hours

Smart City Security Architecture, Smart City Use-Case Examples.	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. • Appraise the role of IoT protocols for efficient network communication. • Elaborate the need for Data Analytics and Security in IoT. • Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) 2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017 	
Reference Books:	
<ol style="list-style-type: none"> 1. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands -on- Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) 2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224) 	

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand Hadoop Distributed File system and examine MapReduce Programming • Explore Hadoop tools and manage Hadoop with Ambari • Appraise the role of Business intelligence and its applications across industries • Assess core data mining techniques for data analytics • Identify various Text Mining techniques 			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Master the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			

2. Anil Maheshwari, "**Data Analytics**", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180

Reference Books:

- 1) Tom White, "**Hadoop: The Definitive Guide**", 4th Edition, O'Reilly Media,
- 2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "**Professional Hadoop Solutions**", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

**HIGH PERFORMANCE COMPUTING [As
per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CS831	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

Module – 1

**Teaching
Hours**

Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)

10 Hours

Module – 2

High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built

10 Hours

Module – 3

Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques

10 Hours

Module – 4

Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)

10 Hours

Module – 5

Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks

10 Hours

Course outcomes: The students should be able to:

- Illustrate the key factors affecting performance of CSE applications, and
- Make mapping of applications to high-performance computing systems, and

- Apply hardware/software co-design for achieving performance on real-world applications

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

MODERN INTERFACE DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS832	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
<ul style="list-style-type: none"> • Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002. 			

Reference Books:

3. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
4. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – VIII			
Subject Code	15CS833	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To understand the need for interoperable network management. • To learn to the concepts and architecture behind standards based network management. • To understand the concepts and terminology associated with SNMP and TMN • To understand network management as a typical distributed application 			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			8 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			
Module – 3			8 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			
Module – 4			8 Hours
Broadband Access Networks, Broadband Access Technology; HFCT			

<p>Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles</p>	
<p>Module – 5</p>	
<p>Network Management Applications: Configuration Management- Network 8 Hours Provisioning, Inventory Management, Network Topology, Fault Management-Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p>	
<p>1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books:</p>	
<p>1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

SYSTEM MODELLING AND SIMULATION
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	15CS834	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module – 1

Teaching Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software:** Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

10 Hours

Module – 2

Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions.

Queuing Models:Characteristics of queuing systems,Queuing notation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont...,Steady-state behavior of M /G/1 queue, Networks of queues,

10 Hours

Module – 3

Random-Number Generation:Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique.

10 Hours

Module – 4

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.

Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Contd..**

10 Hours

Module – 5

Measures of performance and their estimation,Output analysis for terminating simulations Continued...,Output analysis for steady-state simulations.

Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of

10 Hours

simulation models, Calibration and validation of models, Optimization via Simulation.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the system concept and apply functional modeling method to model the activities of a static system • Describe the behavior of a dynamic system and create an analogous model for a dynamic system; • Simulate the operation of a dynamic system and make improvement according to the simulation results. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007 	

INTERNSHIP / PROFESSIONAL PRACTISE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII

Subject Code	15CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Evaluation of Internship :

**PROJECT WORK PHASE II [As per Choice Based Credit System
(CBCS) scheme] (Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 05

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Conduction of Practical Examination:

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – VIII

Subject Code	15CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 02

Course objectives: This course will enable students to

•

Description:

•

Course outcomes: The students should be able to:

•

Evaluation of seminar:

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

III SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics - III	Maths	04		03	60	40	100	4
2	17CS32	Analog and Digital Electronics	CS/IS	04		03	60	40	100	4
3	17CS33	Data Structures and Applications	CS/IS	04		03	60	40	100	4
4	17CS34	Computer Organization	CS/IS	04		03	60	40	100	4
5	17CS35	Unix and Shell Programming	CS/IS	03		03	60	40	100	3
6	17CS36	Discrete Mathematical Structures	CS/IS	04		03	60	40	100	4
7	17CSL37	Analog and Digital Electronics Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL38	Data Structures Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1.Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

IV SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics - IV	Maths	04		03	60	40	100	4
2	17CS42	Object Oriented Concepts	CS/IS	03		03	60	40	100	3
3	17CS43	Design and Analysis of Algorithms	CS/IS	04		03	60	40	100	4
4	17CS44	Microprocessors and Microcontrollers	CS/IS	04		03	60	40	100	4
5	17CS45	Software Engineering	CS/IS	04		03	60	40	100	4
6	17CS46	Data Communication	CS/IS	04		03	60	40	100	4
7	17CSL47	Design and Analysis of Algorithm Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL48	Microprocessors Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

1	17MATDIP41	Additional Mathematics –II	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

V SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS51	Management and Entrepreneurship for IT Industry	CS/IS	04		03	60	40	100	4
2	17CS52	Computer Networks	CS/IS	04		03	60	40	100	4
3	17CS53	Database Management System	CS/IS	04		03	60	40	100	4
4	17CS54	Automata theory and Computability	CS/IS	04		03	60	40	100	4
5	17CS55x	Professional Elective-1	CS/IS	03		03	60	40	100	3
6	17CS56x	Open Elective-1	CS/IS	03		03	60	40	100	3
7	17CSL57	Computer Network Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL58	DBMS Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory: 22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-1		Open Elective – 1*** (List offered by CSE Board only)	
17CS553	Advanced JAVA and J2EE	17CS564	Dot Net framework for application development;

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre – requisite knowledge.
- The candidate has studied similar content course during previous semesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s). Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination 2017-2018 Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VI SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS61	Cryptography, Network Security and Cyber Law	CS/IS	04		03	60	40	100	4
2	17CS62	Computer Graphics and Visualization	CS/IS	04		03	60	40	100	4
3	17CS63	System Software and Compiler Design	CS/IS	04		03	60	40	100	4
4	17CS64	Operating Systems	CS/IS	04		03	60	40	100	4
5	17CS65x	Professional Elective-2	CS/IS	03		03	60	40	100	3
6	17CS66x	Open Elective-2	CS/IS	03		03	60	40	100	3
7	17CSL67	System Software and Operating System Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL68	Computer Graphics Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory:22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-2		Open Elective – 2*** (List offered by CSE Board only)	
17CS651	Data Mining and Data Warehousing	17CS664	Python Application Programming

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre – requisite knowledge.
- The candidate has studied similar content course during previous semesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s). Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS71	Web Technology and its applications	CS/IS	04		03	60	40	100	4
2	17CS72	Advanced Computer Architectures	CS/IS	04		03	60	40	100	4
3	17CS73	Machine Learning	CS/IS	04		03	60	40	100	4
4	17CS74x	Professional Elective 3	CS/IS	03		03	60	40	100	3
5	17CS75x	Professional Elective 4	CS/IS	03		03	60	40	100	3
6	17CSL76	Machine Learning Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17CSL77	Web Technology Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSP78	Project Work Phase-I + Project work Seminar	CS/IS		03	--	--	100	100	2
TOTAL				Theory:18 hours Practical and Project: 09 hours		21	420	380	800	24

Professional Elective-3		Professional Elective-4	
17CS742	Cloud Computing and its Applications	17CS754	Storage Area Networks

1. Project Phase – I and Project Seminar: Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination 2017-2018 Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VIII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS81	Internet of Things and Applications	CS/IS	4	-	3	60	40	100	4
2	17CS82	Big Data Analytics	CS/IS	4	-	3	60	40	100	4
3	17CS83X	Professional Elective-5	CS/IS	3	-	3	60	40	100	3
4	17CS84	Internship/ Professional Practice	CS/IS	Industry Oriented		3	50	50	100	2
5	17CSP85	Project Work-II	CS/IS	-	6	3	100	100	200	6
6	17CSS86	Seminar	CS/IS	-	4	-	-	100	100	1
TOTAL				Theory: 11 hours Project and Seminar: 10 hours		15	330	370	700	20

Professional Elective -5	
17CS834	System Modeling and Simulation

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period.

ENGINEERING MATHEMATICS-III
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17MAT31	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			10Hours
Module -2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			10 Hours
Module – 3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.			10 Hours
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's $(1/3)^{th}$ and $(3/8)^{th}$ rules, Weddle's rule (without proof) – Problems.			10 Hours
Module-5			
Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems.			10 Hours
Course outcomes:			

After Studying this course, students will be able to

- Know the use of periodic signals and Fourier series to analyze circuits and system communications.
- Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.
- Employ appropriate numerical methods to solve algebraic and transcendental equations.
- Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.
- Determine the extremals of functionals and solve the simple problems of the calculus of variations.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.

Reference Books:

1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition.
2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley.
3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed.

ANALOG AND DIGITAL ELECTRONICS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER - III

Subject Code	17CS32	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
<p>Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter.</p> <p>Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)</p>			10 Hours
Module -2			
<p>The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.</p> <p>Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.</p>			10 Hours
Module – 3			
<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>			10 Hours
Module-4			
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>			10 Hours

Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
Course outcomes: After Studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012. 2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015 	
Reference Books:	
<ol style="list-style-type: none"> 1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005. 2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010. 3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008. 	

DATA STRUCTURES AND APPLICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER - III			
Subject Code	17CS33	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
Module -1			Teaching Hours
<p>Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.</p> <p>Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4</p>			10 Hours
Module -2			
<p>Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples.</p> <p>Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13</p>			10 Hours
Module – 3			
<p>Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples</p> <p>Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10</p>			10 Hours

Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7 Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Explain different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Make use of stack, Queue, Lists, Trees and Graphs in problem solving. • Develop all data structures in a high-level language for problem solving. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press,2014 2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014 	
Reference Books:	
<ol style="list-style-type: none"> 1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning,2014 2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012 3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013 4. Data Structures using C - A M Tenenbaum, PHI, 1989 5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996 	

COMPUTER ORGANIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER - III			
Subject Code	17CS34	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions			10Hours
Module -2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.			10 Hours
Module – 3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.			10 Hours
Module-4			
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.			10 Hours
Module-5			
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.			10 Hours
Course outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Build simple arithmetic and logical units. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12)

Reference Books:

1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.

UNIX AND SHELL PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17CS35	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			08 Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			08 Hours
Module – 3			
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>			08 Hours

Module-4	
Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.	08 Hours
Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2	
Module-5	
Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example. Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @- variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.	08 Hours
Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1	
Course outcomes:	
After studying this course, students will be able to: <ul style="list-style-type: none"> • Explain UNIX system and use different commands. • Compile Shell scripts for certain functions on different subsystems. • Demonstrate use of editors and Perl script writing 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill 2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education. 2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2ndEdition , Wiley,2014. 	

DISCRETE MATHEMATICAL STRUCTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17CS36	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,			10Hours
Module -2			
Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.			10 Hours
Module – 3			
Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.			10 Hours
Module-4			
The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,			10 Hours
Module-5			
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes			10 Hours
Course outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Make use of propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Apply different mathematical proofs, techniques in proving theorems. • Compare graphs, trees and their applications. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER - III

Laboratory Code	17CSL37	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 40 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.

<p>6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.</p> <p>7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.</p> <p>8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.</p> <p>b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.</p> <p>9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.</p> <p>b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.</p> <p>10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC- 7447).</p> <p>11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).</p> <p>Study experiment</p> <p>12. To study 4-bit ALU using IC-74181.</p>
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<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit. • Design and demonstrate various combinational logic circuits. • Design and demonstrate various types of counters and Registers using Flip-flops • Make use of simulation package to design circuits. • Infer the working and implementation of ALU.
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<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1 . All laboratory experiments (1 to 11 nos) are to be included for practical examination. 2 . Students are allowed to pick one experiment from the lot. 3 . Strictly follow the instructions as printed on the cover page of answer script. 4 . Marks distribution: <ol style="list-style-type: none"> a) For questions having part a only- Procedure + Conduction + Viva: 15 + 70 +15 =100 Marks b) For questions having part a and b <ol style="list-style-type: none"> Part a- Procedure + Conduction + Viva: 09 + 42 +09= 60 Marks Part b- Procedure + Conduction + Viva: 06 + 28 +06= 40 Marks 5 . Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

(Effective from the academic year 2017 -2018)			
SEMESTER - III			
Laboratory Code	17CSL38	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 02			
Descriptions (if any) <p style="text-align: center;">Implement all the experiments in C Language under Linux / Windows environment.</p>			
Laboratory Experiments: <ol style="list-style-type: none"> 1. Design, Develop and Implement a menu driven Program in C for the following Array operations <ol style="list-style-type: none"> a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. <p>Support the program with functions for each of the above operations.</p> 2. Design, Develop and Implement a Program in C for the following operations on Strings <ol style="list-style-type: none"> a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR <p>Support the program with functions for each of the above operations. Don't use Built-in functions.</p> 3. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) <ol style="list-style-type: none"> a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit <p>Support the program with appropriate functions for each of the above operations</p> 4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands. 5. Design, Develop and Implement a Program in C for the following Stack Applications <ol style="list-style-type: none"> a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks 			

6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
- Insert an Element on to Circular QUEUE
 - Delete an Element from Circular QUEUE
 - Demonstrate *Overflow* and *Underflow* situations on Circular QUEUE
 - Display the status of Circular QUEUE
 - Exit
- Support the program with appropriate functions for each of the above operations

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: *USN, Name, Branch, Sem, PhNo*
- Create a **SLL** of N Students Data by using *front insertion*.
 - Display the status of **SLL** and count the number of nodes in it
 - Perform Insertion / Deletion at End of **SLL**
 - Perform Insertion / Deletion at Front of **SLL**(**Demonstration of stack**)
 - Exit

8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: *SSN, Name, Dept, Designation, Sal, PhNo*
- Create a **DLL** of N Employees Data by using *end insertion*.
 - Display the status of **DLL** and count the number of nodes in it
 - Perform Insertion and Deletion at End of **DLL**
 - Perform Insertion and Deletion at Front of **DLL**
 - Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - Exit

9. Design, Develop and Implement a Program in C for the following operations on **Singly Circular Linked List (SCLL)** with header nodes
- Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$
 - Find the sum of two polynomials **POLY1(x,y,z)** and **POLY2(x,y,z)** and store the result in **POLYSUM(x,y,z)**

Support the program with appropriate functions for each of the above operations

10. Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers
- Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
 - Traverse the BST in Inorder, Preorder and Post Order
 - Search the BST for a given element (**KEY**) and report the appropriate message
 - Exit

11. Design, Develop and Implement a Program in C for the following operations on **Graph(G)** of Cities
- Create a Graph of N cities using Adjacency Matrix.
 - Print all the nodes **reachable** from a given starting node in a digraph using DFS/BFS method

12. Given a File of **N** employee records with a set **K** of Keys(4-digit) which uniquely determine the records in file **F**. Assume that file **F** is maintained in memory by a Hash Table(HT) of **m** memory locations with **L** as the set of memory addresses (2-digit) of locations in HT. Let the keys in **K** and addresses in **L** are Integers. Design and develop a Program in C that uses Hash function **H: K →L** as $H(K)=K \bmod m$ (remainder method), and implement hashing technique to map a given key **K** to the address space **L**. Resolve the collision (if any) using **linear probing**.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Analyze and Compare various linear and non-linear data structures
- Demonstrate the working nature of different types of data structures and their applications
- Develop, analyze and evaluate the searching and sorting algorithms
- Choose the appropriate data structure for solving real world problems

Conduction of Practical Examination:

1. All laboratory experiments (**TWELVE** nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva:**15 + 70 +15 (100)**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

<p style="text-align: center;">ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV</p>			
Subject Code	17MAT41	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
<p>Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor’s series method, modified Euler’s method. Runge - Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae-single step computation only).</p>			10 Hours
Module 2			Teaching Hours
<p>Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne’s method. (No derivations of formulae-single step computation only). Special Functions: Series solution of Bessel’s differential equation leading to $J_n(x)$-Bessel’s function of first kind. Basic properties and orthogonality. Series solution of Legendre’s differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue’s formula, problems</p>			10 Hours
Module 3			Teaching Hours
<p>Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem (without proof) and problems. Transformations: Conformal transformations-Discussion of transformations: $w = z^2$, $w = e^z$, $w = z + (1/z)$ ($z \neq 0$), Bilinear transformations-problems.</p>			10 Hours
Module 4			Teaching Hours
<p>Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.</p>			10 Hours
Module 5			Teaching Hours
<p>Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.</p>			10 Hours
<p>Course Outcomes: After studying this course, students will be able to:</p>			
<ul style="list-style-type: none"> • Solve first and second order ordinary differential equation arising in flow problems using single step and multistep numerical methods. • Illustrate problems of potential theory, quantum mechanics and heat conduction by employing notions and properties of Bessel’s functions and Legendre’s polynomials. • Explain the concepts of analytic functions, residues, poles of complex potentials and describe 			

conformal and Bilinear transformation arising in field theory and signal processing.

- Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and design engineering.
- Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.

Reference Books:

1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition.
2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013.
3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

OBJECT ORIENTED CONCEPTS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS42	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			08 Hours
Module 2			Teaching Hours
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			08 Hours
Module 3			Teaching Hours
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			08 Hours
Module 4			Teaching Hours
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			08 Hours
Module 5			Teaching Hours
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30			08 Hours

<p>Course Outcomes: After studying this course, students will be able to</p> <ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to comprehend the event-based GUI handling principles using Applets and swings.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30)
<p>Reference Book:</p> <ol style="list-style-type: none"> 1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
<p>Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.</p>

DESIGN AND ANALYSIS OF ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS43	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			Teaching Hours
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			Teaching Hours
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			Teaching Hours
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			Teaching Hours
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> Describe computational solution to well known problems like searching, sorting etc. Estimate the computational complexity of different algorithms. 			

- Develop an algorithm using appropriate design strategies for problem solving.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin., 2nd Edition, 2009. Pearson.

T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI

2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)

MICROPROCESSORS AND MICROCONTROLLERS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS44	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code. Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7			10 Hours
Module 2			
x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment. Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2			10 Hours
Module 3			
Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255. Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4			10 Hours
Module 4			
Microprocessors versus Microcontrollers, ARM Embedded Systems : The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5			10 Hours
Module 5			
Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises. Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)			10 Hours
Course Outcomes: After studying this course, students will be able to <ul style="list-style-type: none"> • Differentiate between microprocessors and microcontrollers • Develop assembly language code to solve problems • Explain interfacing of various devices to x86 family and ARM processor • Demonstrate interrupt routines for interfacing devices 			
Question paper pattern:			

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

SOFTWARE ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS45	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities. Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).			12 Hours
Module 2			Teaching Hours
System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).			11 Hours
Module 3			Teaching Hours
Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695). Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).			9 Hours
Module 4			Teaching Hours
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)			10 Hours
Module 5			Teaching Hours
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “The SCRUM Primer, Ver 2.0”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):			8 Hours
Course Outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Make use of techniques, skills, and modern engineering tools necessary for engineering 			

practice

- Comprehend software systems or parts of software systems.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
(Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. The SCRUM Primer, Ver 2.0, <http://www.goodagile.com/scrumpriemer/scrumpriemer20.pdf>

Reference Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

Web Reference for eBooks on Agile:

1. <http://agilemanifesto.org/>
2. <http://www.jamesshore.com/Agile-Book/>

DATA COMMUNICATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS46	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • List and explain the layers of the OSI model and TCP/IP model. • Comprehend the different types of network devices and their functions within a network • Demonstrate subnetting and routing mechanisms. 			
Question paper pattern:			
<p>The question paper will have ten questions.</p> <p>There will be 2 questions from each module.</p> <p>Each question will have questions covering all the topics under a module.</p> <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2017 -2018)

SEMESTER – IV

Subject Code	17CSL47	IA Marks	40
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02**Description**

Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.

Experiments

1	A	Create a Java class called <i>Student</i> with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.
3	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute a/b and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.
4		Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
5		Sort a given set of <i>n</i> integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-

	and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.
Course Outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.) • Develop variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language. • Analyze and compare the performance of algorithms using language features. • Apply and implement learned algorithm design techniques and data structures to solve real-world problems. 	
Conduction of Practical Examination:	
<p>All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot. To generate the data set use random number generator function. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks</p> <p>Marks distribution: Procedure + Conduction + Viva: 15 + 70 + 15 (100). Change of experiment is allowed only once and marks allotted to the procedure</p>	

MICROPROCESSOR AND MICROCONTROLLER LABORATORY**[As per Choice Based Credit System (CBCS) scheme]****(Effective from the academic year 2017 -2018)****SEMESTER – IV**

Subject Code	17CSL48	IA Marks	40
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02**Description**

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element “X” in a list of ‘n’ 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of ‘n’ 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that ‘n’ and ‘r’ are non-negative integers.
5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider’s Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8. a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display $X*Y$.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Summarize 80x86 instruction sets and comprehend the knowledge of how assembly language works.
- Design and develop assembly programs using 80x86 assembly language instructions
- Infer functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: **08 + 35 +07 (50)**
- PART –B: Procedure + Conduction + Viva: **08 + 35 +07 (50)**
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS51	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship • Utilize the resources available effectively through ERP • Make use of IPRs and institutional support in entrepreneurship 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS52	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables. T1: Chap 2			10 Hours
Module – 2			
Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control. T1: Chap 3			10 Hours
Module – 3			
The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7			10 Hours
Module – 4			
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE,Mobility management: Principles,			10 Hours

Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case study: You Tube. Network Support for Multimedia: Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Outline transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Explain the Wireless and Mobile Networks covering IEEE 802.11 Standard • Define Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS53	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			Teaching Hours
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			Teaching Hours
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			Teaching Hours
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms			10 Hours

Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6	
Module – 5	
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures</p> <p>Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.</p>	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Summarize the concepts of database objects; enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design simple database systems • Design code for some application to interact with databases. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
Reference Books:	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS54	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			Teaching Hours
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			Teaching Hours
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			Teaching Hours
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			Teaching Hours
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Tell the core concepts in automata theory and Theory of Computation 			

- Explain how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Interpret Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of Computation.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013
2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PHI, 2012.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013
2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013
3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013
4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998
5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012
6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012.

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS551	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			Teaching Hours
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			Teaching Hours
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			Teaching Hours
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours
Module – 5			Teaching Hours
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.			8 Hours
Course outcomes: The students should be able to:			

- Describe the concepts of object-oriented and basic class modelling.
- Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
- Choose and apply a befitting design pattern for the given problem.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education, 2007.

Reference Books:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons. 2007.
3. Booch, Jacobson, Rumbaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, Pearson, Reprint 2013

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS552	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			Teaching Hours
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			Teaching Hours
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			Teaching Hours
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team. T2: Chapter 17, 20.			8 Hours
Module – 5			Teaching Hours
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and			8 Hours

<p>Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.</p> <p>T2: Chapter 21 & 22, T1 : Chapter 12 & 13</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Identify test cases for any given problem. • Compare the different testing techniques. • Classify the problems according to a suitable testing model. • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CS553	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.			8 Hours
Module – 2			
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.			8 Hours
Module – 3			
String Handling : The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder			8 Hours
Text Book 1: Ch 15			
Module – 4			
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects			8 Hours

Text Book 1: Ch 31 Text Book 2: Ch 11	
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS554	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990 2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996 			

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

PROGRAMMING IN JAVA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS561	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings Text book 1: Ch 2, Ch 3			8 Hours
Module – 2			Teaching Hours
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java’s Selection Statements, Iteration Statements, Jump Statements. Text book 1: Ch 4, Ch 5			8 Hours
Module – 3			Teaching Hours
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.			8 Hours
Module – 4			Teaching Hours
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java’s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. Text book 1: Ch 9, Ch 10			8 Hours
Module – 5			Teaching Hours
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this(), String Handling: The String			8 Hours

Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.	
Text book 1: Ch 12.1,12.2, Ch 13, Ch 15	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)	
Reference Books:	
<ol style="list-style-type: none"> 1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806. 2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017. 	

ARTIFICIAL INTELLIGENCE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS562	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
What is artificial intelligence?, Problems, Problem Spaces and search, Heuristic search technique TextBook1: Ch 1, 2 and 3			8 Hours
Module – 2			
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules, TextBook1: Ch 4, 5 and 6.			8 Hours
Module – 3			
Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures. TextBook1: Ch 7, 8 and 9.			8 Hours
Module – 4			
Strong slot-and-filler structures, Game Playing. TextBook1: Ch 10 and 12			8 Hours
Module – 5			
Natural Language Processing, Learning, Expert Systems. TextBook1: Ch 15,17 and 20			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify the AI based problems • Apply techniques to solve the AI problems • Define learning and explain various learning techniques • Discuss expert systems 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.			
Reference Books:			
1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.			
1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.			
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem			

Solving”, Fourth Edition, Pearson Education, 2002.

3. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.
4. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015

EMBEDDED SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS563	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.			8 Hours
Module – 2			
Devices and communication buses for devices network: IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.			8 Hours
Module – 3			
Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.			8 Hours
Module – 4			
Inter process communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.			8 Hours
Module – 5			
Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded software development process and tools, Host and target machines, Linking and location software.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> Distinguish the characteristics of embedded computer systems. 			

- Identify the various vulnerabilities of embedded computer systems.
- Design and develop modules using RTOS.
- Explain RPC, threads and tasks

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Raj Kamal, "Embedded Systems: Architecture, Programming, and Design" 2nd / 3rd edition, Tata McGraw hill-2013.

Reference Books:

1. Marilyn Wolf, "Computer as Components, Principles of Embedded Computing System Design" 3rd edition, Elsevier-2014.

DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS564	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions T1: Chapter 1 – Chapter 6			8 Hours
Module – 2			
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays Textbook 1: Ch 7 to 10			8 Hours
Module – 3			
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management Textbook 1: Ch 11 to 14			8 Hours
Module – 4			
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections Textbook 1: Ch 15 to 18			8 Hours
Module – 5			
Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading Textbook 1: Ch 19 to 22			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C# • Demonstrate Object Oriented Programming concepts in C# programming language • Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications. • Illustrate the use of generics and collections in C# • Compose queries to query in-memory data and define own operator behaviour 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. John Sharp, Microsoft Visual C# Step by Step, 8 th Edition, PHI Learning Pvt. Ltd. 2016			

Reference Books:

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016.
Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS565	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology</p>			8 Hours
Module – 2			8 Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			8 Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.</p> <p>High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming</p>			8 Hours

Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, , Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts and terminologies of cloud computing • Demonstrate cloud frameworks and technologies • Define data intensive computing • Demonstrate cloud applications 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
NIL	

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CSL57	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.
- Implement and analyze networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script

4. Marks distribution: Procedure + Conduction + Viva: 100

Part A: 8+35+7 =50

Part B: 8+35+7 =50

5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CSL58	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id, Branch_id, No-of_Copies) BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH(Branch_id, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day.

	<p>5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.</p>
3	<p>Consider the schema for Movie Database: ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars) Write SQL queries to</p> <ol style="list-style-type: none"> List the titles of all movies directed by 'Hitchcock'. Find the movie names where one or more actors acted in two or more movies. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database: STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA) Write SQL queries to</p> <ol style="list-style-type: none"> List all the student details studying in fourth semester 'C' section. Compute the total number of male and female students in each semester and in each section. Create a view of Test1 marks of student USN '1BI17CS101' in all subjects. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database: EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours) Write SQL queries to</p> <ol style="list-style-type: none"> Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department

	<ol style="list-style-type: none"> 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
Part B: Mini project	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Use Structured Query Language (SQL) for database Creation and manipulation. • Demonstrate the working of different concepts of DBMS • Implement and test the project developed for an application. 	
Conduction of Practical Examination: <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 40 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 09 + 42 + 09 = 60 Marks 7. Part B: Demonstration + Report + Viva voce = 20+14+06 = 40 Marks 8. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS61	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Intrusion Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Discuss the cryptography and its need to various applications • Design and Develop simple cryptography algorithms 			

- Understand the cyber security and need cyber Law

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25

Reference Books:

1. Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyay, Mc-GrawHill, 3rd Edition, 2015
2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition
3. Cyber Law simplified- VivekSood, Mc-GrawHill, 11th reprint , 2013
4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindrakumar, Cengage learning

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS62	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms(Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3			10 Hours
Module – 4			
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from			10 Hours

<p>world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions.</p> <p>Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14</p>	
Module – 5	
<p>Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.</p> <p>Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10</p> <p>Text-2:Chapter 3: 3-1 to 3.11: Input& interaction</p>	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Understand the concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Discuss about suitable hardware and software for developing graphics packages using OpenGL. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4thEdition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M MRaiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS63	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Illustrate system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Discuss about lex and yacc tools for implementing different concepts of system software 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. System Software by Leland. L. Beck, D Manjula, 3 rd edition, 2012			

2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS64	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			Teaching Hours
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			Teaching Hours
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			Teaching Hours
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			Teaching Hours
Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output;			10 Hours

Inter-process communication.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Discuss suitable techniques for management of different resources • Illustrate processor, memory, storage and file system commands • Explain the different concepts of OS in platform of usage through case studies 	
Question paper pattern:	
The question paper will have TEN questions.	
There will be TWO questions from each module.	
Each question will have questions covering all the topics under a module.	
The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7 th edition, Wiley-India, 2006.	
Reference Books	
1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6 th Edition	
2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013.	
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.	
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS651	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Data Warehousing&modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse,Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.: Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction,Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers,Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understands data mining problems and implement the data warehouse • Demonstrate the association rules for a given data pattern. • Discuss between classification and clustering solution. 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining,			

Pearson, First impression,2014.

2. Jiawei Han, MichelineKamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition,Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS652	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Demonstrate code qualities needed to keep code flexible • Illustrate design principles and be able to assess the quality of a design with respect to these principles. • Explain principles in the design of object oriented systems. • Understand a range of design patterns. • Discuss suitable patterns in specific contexts 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			

1. Object-oriented analysis, design and implementation, brahma dathan, sarnathrammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS653	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain optimization techniques for various problems. • Understand the given problem as transportation and assignment problem and solve. • Illustrate game theory for decision support system. 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, KedarNath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS654	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			Teaching Hours
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			Teaching Hours
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			Teaching Hours
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			Teaching Hours
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5 th Edition, Pearson Publications, 2009			

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. SunitaMahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS661	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Get started, Build your first app, Activities, Testing, debugging and using support libraries			8 Hours
Module – 2			
User Interaction, Delightful user experience, Testing your UI			8 Hours
Module – 3			
Background Tasks, Triggering, scheduling and optimizing background tasks			8 Hours
Module – 4			
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders			8 Hours
Module – 5			
Permissions, Performance and Security, Firebase and AdMob, Publish			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and Develop Android application by setting up Android development environment • Implement adaptive, responsive user interfaces that work across a wide range of devices. • Explain long running tasks and background work in Android applications • Demonstrate methods in storing, sharing and retrieving data in Android applications • Discuss the performance of android applications and understand the role of permissions and security • Describe the steps involved in publishing Android application to share with the world 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)			
Reference Books:			
1. Erik Hellman, "Android Programming – Pushing the Limits", 1 st Edition, Wiley India Pvt Ltd, 2014. 2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1 st Edition, O'Reilly SPD Publishers, 2015. 3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4 th Edition,			

Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

4. AnubhavPradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS662	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
<p>Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step Modeling Process. Describing the Distribution of a Single Variable: Introduction, Basic Concepts, Populations and Samples, Data Sets, Variables, and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools, Charts for Numerical Variables, Time Series Data, Outliers and Missing Values, Outliers, Missing Values, Excel Tables for Filtering, Sorting, and Summarizing.</p> <p>Finding Relationships among Variables: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables.</p>			08 Hours
Module – 2			Teaching Hours
<p>Probability and Probability Distributions: Introduction, Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation.</p> <p>Normal, Binormal, Poisson, and Exponential Distributions: Introduction, The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density, Standardizing: Z-Values, Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution.</p>			08 Hours
Module – 3			Teaching Hours
<p>Decision Making under Uncertainty: Introduction, Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary Value (EMV), Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In, Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility</p>			08 Hours

<p>Maximization Used?</p> <p>Sampling and Sampling Distributions: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling.</p>	
Module – 4	
<p>Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters.</p> <p>Hypothesis Testing: Introduction, Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence.</p>	08 Hours
Module – 5	
<p>Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships, Outliers, Unequal Variance, No Relationship, Correlations: Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained: R-Square, Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit.</p> <p>Regression Analysis: Statistical Inference: Introduction, The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table, Multicollinearity, Include/Exclude Decisions, Stepwise Regression, Outliers, Violations of Regression Assumptions, Nonconstant Error Variance, Nonnormality of Residuals, Autocorrelated Residuals, Prediction.</p>	08 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the importance of data and data analysis • Interpret the probabilistic models for data • Illustrate hypothesis, uncertainty principle • Demonstrate the regression analysis 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module.</p>	

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cengage Learning

Reference Books:

WIRELESS NETWORKS AND MOBILE COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VI

Subject Code	17CS663	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Module – 1	Teaching Hours
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Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices Mobile System Networks, Data Dissemination, Mobility Management, Security Cellular Networks and Frequency Reuse, Mobile Smartphone, Smart Mobiles, and Systems Handheld Pocket Computers, Handheld Devices, Smart Systems, Limitations of Mobile Devices
Automotive Systems

8 Hours

Module – 2

GSM-Services and System Architecture, Radio Interfaces of GSM, Protocols of GSM Localization, Call Handling Handover, Security, New Data Services, General Packet Radio Service High-speed Circuit Switched Data, DECT, Modulation, Multiplexing, Controlling the Medium Access Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Coding Methods, Code Division Multiple Access, IMT-2000 3G Wireless Communication Standards, WCDMA 3G Communications Standards ,CDMMA2000 3G Communication Standards, I-mode, OFDM, High Speed Packet Access (HSPA) 3G Network Long-term Evolution, WiMaxRel 1.0 IEEE 802.16e, Broadband Wireless Access, 4G Networks, Mobile Satellite Communication Networks

8 Hours

Module – 3

IP and Mobile IP Network Layers, Packet Delivery and Handover Management Location Management, Registration, Tunnelling and Encapsulation, Route Optimization Dynamic Host Configuration Protocol, VoIP, IPsec Conventional TCP/IP Transport Layer Protocols, Indirect TCP, Snooping TCP Mobile TCP, Other Methods of Mobile TCP-layer Transmission ,TCP over 2.5G/3G Mobile Networks

8 Hours

Module – 4

Data Organization, Database Transactional Models – ACID Rules, Query Processing Data Recovery Process, Database Hoarding Techniques , Data Caching, Client-Server Computing for Mobile Computing and Adaptation Adaptation Software for Mobile Computing, Power-Aware Mobile Computing, Context-aware Mobile Computing

8 Hours

Module – 5

Communication Asymmetry, Classification of Data-delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing techniques, Digital Audio Broadcasting (DAB), Digital Video Broadcasting Synchronization, Synchronization Software for Mobile Devices, Synchronization Software for Mobile Devices SyncML-Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia Markup Language (SMIL)

8 Hours

Course outcomes: The students should be able to:

- Understand the various mobile communication systems.
- Describe various multiplexing systems used in mobile computing.
- Explain the use and importance of data synchronization in mobile computing

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Raj kamal: Mobile Computing, 2ND EDITION, Oxford University Press, 2007/2012
2. MartynMallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

PYTHON APPLICATION PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VI

Subject Code	17CS664	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Module – 1	Teaching Hours
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions	8 Hours
Module – 2	
Iteration, Strings, Files	8 Hours
Module – 3	
Lists, Dictionaries, Tuples, Regular Expressions	8 Hours
Module – 4	
Classes and objects, Classes and functions, Classes and methods	8 Hours
Module – 5	
Networked programs, Using Web Services, Using databases and SQL	8 Hours

Course outcomes: The students should be able to:

- Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (<http://greenteapress.com/thinkpython2/thinkpython2.pdf>) (Chapters 15, 16, 17)(Download pdf files from the above links)

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, “Programming Python”, 4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873

3. Wesley J Chun, “Core Python Applications Programming”, 3rdEdition, Pearson Education India, 2015. ISBN-13: 978-9332555365
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”, 1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. ReemaThareja, “Python Programming using problem solving approach”, Oxford university press, 2017

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS665	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
SOA BASICS:Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise-Wide SOA, Strawman Architecture For Enterprise-Wide-SOA-Enterprise, SOA-Layers, Application Development Process, SOA Methodology For Enterprise Text 1: Ch2: 2.1 – 2.4; Ch3:3.1-3.7; Ch4: 4.1 – 4.5			8 Hours
Module – 2			
Enterprise Applications; Architecture Considerations, Solution Architecture for enterprise application, Software platforms for enterprise Applications; Package Application Platforms, Enterprise Application Platforms, Service-oriented-Enterprise Applications; Considerations for Service-Oriented Enterprise Applications, Patterns for SOA, Pattern-Based Architecture for Service-Oriented Enterprise Application(java reference model only).Composite Applications, SOA programming models. Text 1: Ch5:5.1, 5.2, 6.1, 6.2(PageNo 74-81), 7.1 – 7.5			8 Hours
Module – 3			
SOA ANALYSIS AND DESIGN; Need For Models, Principles of Service Design, Design of Activity Services, Design of Dataservices, Design of Client services and Design of business process services, Technologies of SOA; Technologies For Service Enablement, Technologies For Service Integration, Technologies for Service orchestration. Text 1: Ch 8: 8.1 – 8.6, 9.1 – 9.3			8 Hours
Module – 4			
Business case for SOA; Stakeholder OBJECTIVES, Benefits of SOA, Cost Savings, Return on Investment, SOA Governance, Security and implementation; SOA Governance, SOA Security, approach for enterprise wide SOA implementation, Trends in SOA; Technologies in Relation to SOA, Advances in SOA. Text 1: Ch 10: 10.1 -10.4, Ch 11: 11.1 to 11.3, Ch12:12.2, 12.3			8 Hours
Module – 5			
SOA Technologies-PoC; Loan Management System(LMS), PoC-Requirements Architectures of LMS SOA based integration; integrating existing application, SOA best practices, Basic SOA using REST. Role of WSDL,SOAP and JAVA/XML Mapping in SOA. Text 1:Page No 245-248; ReferenceBook:Chapter3; Text 1:Page No 307-310 Text 2: Ch 3, Ch4			8 Hours
Course outcomes: The students should be able to:			

- Understand the different IT architectures
- Explain SOA based applications
- Illustrate web service and realization of SOA
- Discuss RESTful services

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley Second Edition, 2014.
2. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.

Reference Books:

1. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

MULTI-CORE ARCHITECTURE AND PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS666	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl’s Law, Growing Returns: Gustafson’s Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.			8 Hours
Module – 2			
Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You’ll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features			8 Hours
Module – 3			
Threading APIs :ThreadingAPIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.			8 Hours
Module – 4			
OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance			8 Hours
Module – 5			
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks,			8 Hours

Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify the issues involved in multicore architectures • Explain fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Discuss salient features of different multicore architectures and how they exploit parallelism • Illustrate OpenMP and programming concept 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
1. Multicore Programming , Increased Performance through Software Multi-threading by ShameemAkhter and Jason Roberts , Intel Press , 2006	
Reference Books:	
NIL	

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VI

Subject Code	17CSL67	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use *data input file* where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid *arithmetic expression*. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate *arithmetic expression* involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with *b* preceded by *na*'s using the grammar $a^n b$ (note: input *n* value)
3. Design, develop and implement YACC/C program to construct *Predictive / LL(1) Parsing Table* for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: *abba*\$
4. Design, develop and implement YACC/C program to demonstrate *Shift Reduce Parsing* technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: *id + id * id*.
5. Design, develop and implement a C/Java program to generate the machine code using *Triples* for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$
6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the

resulting program into a separate file.

b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (*C program*) file.

7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Implement different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **15 + 70 + 15 (100)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CSL68	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham's line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic:sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Apply the concepts of computer graphics • Implement computer graphics applications using OpenGL • Implement real world problems using OpenGL 			
Conduction of Practical Examination:			

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 40 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: **09 + 42 + 09 = 60 Marks**
 - b) Part B: Demonstration + Report + Viva voce = **20+14+06 = 40 Marks**
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version, 3rd Edition, Pearson Education, 2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M MRaikar, Computer Graphics using OpenGL, Fillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS71	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.			10 Hours
Module – 2			Teaching Hours
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.			10 Hours
Module – 3			Teaching Hours
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions			10 Hours
Module – 4			Teaching Hours
PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling			10 Hours
Module – 5			Teaching Hours
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Define HTML and CSS syntax and semantics to build web pages. • Understand the concepts of Construct , visually format tables and forms using HTML using CSS • Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically. • List the principles of object oriented development using PHP • Illustrate JavaScript frameworks like jQuery and Backbone which facilitates 			

developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS72	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo’s Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.			10 Hours
Course outcomes: The students should be able to:			

- Understand the concepts of parallel computing and hardware technologies
- Illustrate and contrast the parallel architectures
- Recall parallel programming concepts

Question paper pattern

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elsevier, 2013

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS73	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Module – 1	Teaching Hours
<p>Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.</p> <p>Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.</p> <p>Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7</p>	10 Hours
Module – 2	
<p>Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.</p> <p>Text Book1, Sections: 3.1-3.7</p>	10 Hours
Module – 3	
<p>Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.</p> <p>Text book 1, Sections: 4.1 – 4.6</p>	08 Hours
Module – 4	
<p>Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm</p> <p>Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12</p>	10 Hours
Module – 5	
<p>Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.</p> <p>Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,</p> <p>Reinforcement Learning: Introduction, Learning Task, Q Learning</p> <p>Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3</p>	12 Hours
<p>Course Outcomes: After studying this course, students will be able to</p> <ul style="list-style-type: none"> • Recall the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning. • Understand theory of probability and statistics related to machine learning • Illustrate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module.</p>	

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS741	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Matrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours
Module – 5			
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.			8 Hours

Course outcomes: The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000.

CLOUD COMPUTING AND ITS APPLICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS742	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V</p>			8 Hours
Module – 2			Teaching Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			Teaching Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.</p> <p>High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications,</p>			8 Hours

Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Understand the concepts of cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Define the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS743	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley 2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin Oxford Scholarship Online: December 2013 			

Reference Books:

1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS744	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand the working of Unix Systems • Illustrate the application/service over a UNIX system. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005.

Reference Books:

1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.
2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987.
3. Unix Internals - Uresh Vahalia, Pearson Education, 2001.

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS751	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to: <ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books: 1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015			
Reference Books: 1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, 2011.			

<p style="text-align: center;">COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII</p>			
Subject Code	17CS752	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis 			

- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS753	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books: <ol style="list-style-type: none"> 1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008. 			
Reference Books: <ol style="list-style-type: none"> 1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India 			

Ltd, Fourth Edition.

2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS754	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Storage System Introduction to evolution of storage architecture, key data center elements, virtualization, and cloud computing. Key data center elements – Host (or compute), connectivity, storage, and application in both classic and virtual environments. RAID implementations, techniques, and levels along with the impact of RAID on application performance. Components of intelligent storage systems and virtual storage provisioning and intelligent storage system implementations.			8 Hours
Module – 2			
Storage Networking Technologies and Virtualization Fibre Channel SAN components, connectivity options, and topologies including access protection mechanism ‘zoning’, FC protocol stack, addressing and operations, SAN-based virtualization and VSAN technology, iSCSI and FCIP protocols for storage access over IP network, Converged protocol FCoE and its components, Network Attached Storage (NAS) - components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.			8 Hours
Module – 3			
Backup, Archive, and Replication This unit focuses on information availability and business continuity solutions in both virtualized and non-virtualized environments. Business continuity terminologies, planning and solutions, Clustering and multipathing architecture to avoid single points of failure, Backup and recovery - methods, targets and topologies, Data deduplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection			8 Hours
Module – 4			
Cloud Computing Characteristics and benefits This unit focuses on the business drivers, definition, essential characteristics, and phases of journey to the Cloud. ,Business drivers for Cloud computing, Definition of Cloud computing, Characteristics of Cloud computing, Steps involved in transitioning from Classic data center to Cloud computing environment Services and deployment models, Cloud infrastructure components, Cloud migration considerations			8 Hours
Module – 5			
Securing and Managing Storage Infrastructure This chapter focuses on framework and domains of storage security along with covering security. implementation at storage networking. Security threats, and countermeasures in various domains Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle management (ILM) and storage tiering,			8 Hours

Cloud service management activities	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CSL76	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

1. Understand the implementation procedures for the machine learning algorithms.

2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **15 + 70 + 15 (100)**

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CSL77	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.
9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
 - a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.

- b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.ias as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

1. In the examination each student picks one question from part A.
2. A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
3. The team must submit a brief project report (15-20 pages) that must include the following
 - a. Introduction
 - b. Requirement Analysis
 - c. Software Requirement Specification
 - d. Analysis and Design
 - e. Implementation
 - f. Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Understand the concepts of Web Application Terminologies, Internet Tools other web services.
- Recall how to link and publish web sites

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 40 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: **09 + 42 + 09 = 60 Marks**
 - b) Part B: Demonstration + Report + Viva voce **20+14+06 = 40 Marks**

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

<p style="text-align: center;">INTERNET OF THINGS TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII</p>			
Subject Code	17CS81	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. 			

- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "**IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things**", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "**Internet of Things**", CENGAGE Learning India, 2017

Reference Books:

1. Vijay Madiseti and ArshdeepBahga, "**Internet of Things (A Hands-on-Approach)**", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "**Internet of Things: Architecture and Design Principles**", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS82	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			
2. Anil Maheshwari, " Data Analytics ", 1 st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180			
Reference Books:			
1) Tom White, " Hadoop: The Definitive Guide ", 4 th Edition, O'Reilly Media, 2015. ISBN-13: 978-9352130672			
2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, " Professional Hadoop			

Solutions", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071

- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

HIGH PERFORMANCE COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS831	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)			08 Hours
Module – 2			
High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built			08 Hours
Module – 3			
Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques			08 Hours
Module – 4			
Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)			08 Hours
Module – 5			
Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks			08 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Illustrate the key factors affecting performance of CSE applications • Illustrate mapping of applications to high-performance computing systems • Apply hardware/software co-design for achieving performance on real-world applications 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

USER INTERFACE DESIGN
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	17CS832	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
1. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002.			

Reference Books:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
2. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS833	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			8 Hours
Module – 3			
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			8 Hours
Module – 4			
Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the			8 Hours

ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
Module – 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Infer SNMP for managing the network • Infer RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008. 	

<p style="text-align: center;">SYSTEM MODELLING AND SIMULATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII</p>			
Subject Code	17CS834	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
<p>Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. General Principles, Simulation Software: Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling</p>			08 Hours
Module – 2			
<p>Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions. Queuing Models:Characteristics of queuing systems,Queuing notation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont...,Steady-state behavior of M/G/1 queue, Networks of queues,</p>			08 Hours
Module – 3			
<p>Random-Number Generation:Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, Random-Variate Generation: ,Inverse transform technique Acceptance-Rejection technique.</p>			08 Hours
Module – 4			
<p>Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, Contd..</p>			08 Hours
Module – 5			
<p>Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations. Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation.</p>			08 Hours
Course outcomes: The students should be able to:			

- Explain the system concept and apply functional modeling method to model the activities of a static system
- Describe the behavior of a dynamic system and create an analogous model for a dynamic system;
- Illustrate the operation of a dynamic system and make improvement according to the simulation results.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007

INTERNSHIP / PROFESSIONAL PRACTISE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Description (If any):

With reference to the above subject, this is to inform that the following are the guidelines to be followed for the Internship Programme and the earlier circular as cited in ref (i) is hereby withdrawn:

- 1) As per the 15OB.9 the Internship Programme duration is of Eight weeks. However it has been reduced to Four weeks and it should be carried out between (VI and VII Semester) Vacation and/or (VII and VIII Semester) Vacation.
- 2) The internship can be carried out in any Industry/R and D Organization/Research Institute/ Educational institute of repute.
- 3) The Institutions may also suggest the students to enrol for the Internshala platform for free internships as there is a MoU with the AICTE for the beneficial of the affiliated Institutions (<https://internshala.com/>)
- 4) The Examination of Internship will be carried out in line with the University Project Viva-voce examination.
- 5) (a) The Department/college shall nominate staff member/s to facilitate, guide and supervise students under internship. (b) The Internal Guide has to visit place of internship at least once during the student's internship.
- 6) The students shall report the progress of the internship to the guide in regular intervals and seek his/her advice.
- 7) After the completion of Internship, students shall submit a report with completion and attendance certificates to the Head of the Department with the approval of both internal and external guides.
- 8) The Examination of Internship will be carried out in line with the University Project Viva-voce examination.
- 9) There will be 50 marks for CIE (Seminar: 25, Internship report: 25) and 50 marks for Viva – Voce conducted during SEE. The minimum requirement of CIE marks shall be 50% of the maximum marks.
- 10) The internal guide shall award the marks for seminar and internship report after evaluation. He/she will also be the internal examiner for Viva – Voce conducted during SEE.
- 11) The external guide from the industry shall be an examiner for the viva voce on Internship. Viva-Voce on internship shall be conducted at the college and the date of Viva-Voce shall be fixed in consultation with the external Guide. The Examiners shall jointly award the Viva - Voce marks.

12) In case the external Guide expresses his inability to conduct viva voce, the Chief Superintendent of the institution shall appoint a senior faculty of the Department to conduct viva-voce along with the internal guide. The same shall be informed in writing to the concerned Chairperson, Board of Examiners (BOE).

13) The students are permitted to carry out the internship anywhere in India or abroad. The University will not provide any kind of financial assistance to any student for carrying out the Internship.

Course outcomes: The students should be able to:

1. Adapt easily to the industry environment
2. Take part in team work
3. Make use of modern tools
4. Decide upon project planning and financing.
5. Adapt ethical values.
6. Motivate for lifelong learning

PROJECT WORK PHASE II
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 06

Description (If any):

- Project: Carried out at the Institution or at an Industry.
- Project work shall preferably be batch wise, the strength of each batch shall not exceed maximum of four students
- Viva-voce examination in project work shall be conducted batch-wise.
- For Project Phase –I and Project seminar and Project Phase –II, the CIE shall be 100 respectively.
- The CIE marks in the case of projects in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project guide.
- Minimum requirement of CIE marks for Project work shall be 50% of the maximum marks.
- Students failing to secure a minimum of 50% of the CIE marks in Project work shall not be eligible for the Project examination conducted by the University and they shall be considered as failed in that/those Course/s. However, they can appear for University examinations conducted in other Courses of the same semester and backlog Courses if any. Students after satisfying the prescribed minimum CIE marks in the Course/s when offered during subsequent semester shall appear for SEE.
- Improvement of CIE marks shall not be allowed in Project where the student has already secured the minimum required marks
- For a pass in a Project/Viva-voce examination, a student shall secure a minimum of 40% of the maximum marks prescribed for the University Examination. The Minimum Passing Grade in a Course is ‘E’.
- The student who desires to reject the results of a semester shall reject performance in all the Courses of the semester, irrespective of whether the student has passed or failed in any Course. However, the rejection of performance of VIII semester project shall not be permitted

Course outcomes: The students should be able to:

1. Identify a issue and derive problem related to society, environment, economics, energy and technology
2. Formulate and Analyze the problem and determine the scope of the solution chosen
3. Determine , dissect, and estimate the parameters, required in the solution.
4. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metrics.
5. Compile the report and take part in present / publishing the finding in a reputed conference / publications
6. Attempt to obtain ownership of the solution / product developed.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 01

Description:

- Seminar: Deliverable at the Institution under the supervision of a Faculty.
- Seminar is one of the head of passing. i) Each candidate shall deliver seminar as per the Scheme of Teaching and Examination on the topics chosen from the relevant fields for about 30 minutes. ii) The Head of the Department shall make arrangements for conducting seminars through concerned faculty members of the Department. The committee constituted for the purpose by the Head of the Department shall award the CIE marks for the seminar. The committee shall consist of three faculty from the Department and the senior most acting as the Chairman/Chairperson. [To be read along with 17 OB 8.6]
- For Technical seminar, the CIE marks shall be 100.
- The CIE marks in the case of projects and seminars in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project / seminar guide.
- For seminar, the minimum requirement of CIE marks shall be 40% of the maximum marks.
- If any student fails to secure a minimum of 40% of the maximum CIE marks in seminar/ fails to deliver the seminar, he/she shall be considered as failed in that Course and shall not be eligible for the award of degree. However, the student shall become eligible for the award of degree after satisfying the requirements prescribed for seminar during the subsequent semester/s.
- Improvement of CIE marks shall not be allowed in Seminar where the student has already secured the minimum required marks.
- Seminar topics must be from recent advancements in the domain.
- Each candidate must submit three copies of the report to the department. One for the candidate, one for the guide and one for the department.

Course outcomes: The students should be able to:

- Survey the changes in the technologies relevant to the topic selected
- Discuss the technology and interpret the impact on the society, environment and domain.
- Compile report of the study and present to the audience, following the ethics.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT31	Engineering Mathematics - III	04	--	03	80	20	100	4
2	15CS32	Analog and Digital Electronics	04	--	03	80	20	100	4
3	15CS33	Data Structures and Applications	04	--	03	80	20	100	4
4	15CS34	Computer Organization	04	--	03	80	20	100	4
5	15CS35	Unix and Shell Programming	04	--	03	80	20	100	4
6	15CS36	Discrete Mathematical Structures	04	--	03	80	20	100	4
7	15CSL37	Analog and Digital Electronics Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL38	Data Structures Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15MAT41	Engineering Mathematics - IV	04	--	03	80	20	100	4
2	15CS 42	Software Engineering	04	--	03	80	20	100	4
3	15CS43	Design and Analysis of Algorithms	04	--	03	80	20	100	4
4	15CS 44	Microprocessors and Microcontrollers	04	--	03	80	20	100	4
5	15CS45	Object Oriented Concepts	04	--	03	80	20	100	4
6	15CS46	Data Communication	04	--	03	80	20	100	4
7	15CSL47	Design and Analysis of Algorithm Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL48	Microprocessors Laboratory	--	1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note: 'I' Stands for Instruction Hours and 'P' for practical Hours

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS51	Management and Entrepreneurship for IT Industry	04	--	03	80	20	100	4
2	15CS52	Computer Networks	04	--	03	80	20	100	4
3	15CS53	Database Management System	04	--	03	80	20	100	4
4	15CS54	Automata theory and Computability	04	--	03	80	20	100	4
5	15CS55x	Professional Elective 1	03	--	03	80	20	100	3
6	15CS56x	Open Elective 1	03	--	03	80	20	100	3
7	15CSL57	Computer Network Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL58	DBMS Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 1		Open Elective	
15CS553	Advanced JAVA and J2EE	15CS564	Dot Net framework for application development;

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. Computer Science & Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CS61	Cryptography, Network Security and Cyber Law	04	--	03	80	20	100	4
2	15CS62	Computer Graphics and Visualization	04	--	03	80	20	100	4
3	15CS63	System Software and Compiler Design	04	--	03	80	20	100	4
4	15CS64	Operating Systems	04	--	03	80	20	100	4
5	15CS65x	Professional Elective 2	03	--	03	80	20	100	3
6	15CS66x	Open Elective 2	03	--	03	80	20	100	3
7	15CSL67	System Software and Operating System Laboratory	--	1I+2P	03	80	20	100	2
8	15CSL68	Computer Graphics Laboratory with mini project	--	1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective 2		Open elective	
15CS651	Data Mining and Data Warehousing	15CS664	Python Application Programming

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Open Elective: Electives from other technical and/or emerging subject areas (Announced separately)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS71	Web Technology and its applications	04	--	03	20	80	100	4
2	15CS72	Advanced Computer Architectures	04	--	03	20	80	100	4
3	15CS73	Machine Learning	04	--	03	20	80	100	4
4	15CS74x	Professional Elective 3	03	--	03	20	80	100	3
5	15CS75x	Professional Elective 4	03	--	03	20	80	100	3
6	15CSL76	Machine Learning Laboratory	--	1I+2P	03	20	80	100	2
7	15CSL77	Web Technology Laboratory with mini project	--	1I+2P	03	20	80	100	2
8	15CSP78	Project Phase 1 + Seminar	--	--	--	100	--	100	2
TOTAL			18	6	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CS742	Cloud Computing and its Applications	15CS754	Storage Area Networks

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Project Phase 1 + Seminar : Literature Survey, Problem Identification, Objectives and Methodology, Submission of Synopsis and Seminar

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
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SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Computer Science & Engineering
 VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CS81	Internet of Things and Applications	4	--	3	20	80	100	4
2	15CS82	Big Data Analytics	4	--	3	20	80	100	4
3	15CS83x	Professional Elective 5	3	--	3	20	80	100	3
4	15CS84	Internship / Professional Practice	Industry Oriented		3	50	50	100	2
5	15CSP85	Project work phase II	--	6	3	100	100	200	5
6	15CSS86	Seminar	--	4	--	100	--	100	2
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CS834	System Modeling and Simulation

1. Professional Elective: Electives relevant to chosen specialization / branch
2. Internship / Professional Practice: To be carried out between 6th and 7th semester vacation or 7th and 8th semester vacation period

ENGINEERING MATHEMATICS-III

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Comprehend and use of analytical and numerical methods in different engineering fields • Apprehend and apply Fourier Series • Realize and use of Fourier transforms and Z-Transforms • Use of statistical methods in curve fitting applications • Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation 			
Module -1			Teaching Hours
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of Periodic functions with period 2π and with arbitrary period $2c$, Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis. Complex Fourier series</p>			10Hours
Module -2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse transform. Z-transform: Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.</p>			10 Hours
Module – 3			
<p>Statistical Methods: Correlation and rank Correlation coefficients, Regression and Regression coefficients, lines of regression - problems Curve fitting: Curve fitting by the method of least squares, Fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c, y = ae^{bx}, y = ax^b$. Numerical Methods: Numerical solution of algebraic and transcendental equations by: Regular-falsi method, Secant method, Newton - Raphson method and Graphical method.</p>			10 Hours
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula. Central Difference-Stirling's and Bessel's formulae (all formulae without proof)-Problems. Numerical integration: Simpson's 1/3, 3/8 rule, Weddle's rule (without proof) -Problems</p>			10 Hours

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem (without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, minimal surface of revolution, hanging chain, problems</p>	10 Hours
Course outcomes:	
<p>After Studying this course, students will be able to</p> <ul style="list-style-type: none"> • Use of periodic signals and Fourier series to analyze circuits • Explain the general linear system theory for continuous-time signals and systems using the Fourier Transform • Analyze discrete-time systems using convolution and the z-transform • Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral • Use curl and divergence of a vector function in three dimensions, as well as apply the Green's Theorem, Divergence Theorem and Stokes' theorem in various applications • Solve the simple problem of the calculus of variations 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 4. Conduct Investigations of Complex Problems 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013. 2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 	
Reference Books:	
<ol style="list-style-type: none"> 1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley. 3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed. 	

ANALOG AND DIGITAL ELECTRONICS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable the students to			
<ul style="list-style-type: none">• Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT• Evolve and Analyze Operational Amplifier circuits and their applications• Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.• Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.• Describe, Design and Analyze Synchronous and Asynchronous Sequential• Explain and design registers and Counters, A/D and D/A converters.			
Module -1			Teaching Hours
Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter. Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)			10 Hours
Module -2			
The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models. Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.			10 Hours
Module – 3			

<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>	10 Hours
Module-4	
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>	10 Hours
Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
Course outcomes: After Studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions(partly) 3. Modern Tool Usage 4. Problem Analysis 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015

Reference Books:

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

DATA STRUCTURES AND APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Illustrate linear representation of data structures: Stack, Queues, Lists • Illustrate linear representation of data structures: Trees, Graphs • Demonstrate sorting and searching algorithms • Find suitable data structure during application development/Problem Solving 			
Module -1			Teaching Hours
<p>Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4</p>			10 Hours
Module -2			
<p>Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13</p>			10 Hours
Module – 3			

<p>Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples</p> <p>Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10</p>	10 Hours
Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7 Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9 Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
Course outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Use different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Use stack, Queue, Lists, Trees and Graphs in problem solving • Implement all data structures in a high-level language for problem solving. 	
Graduate Attributes (as per NBA)	
<ol style="list-style-type: none"> 1. Engineering Knowledge 2. Design/Development of Solutions 3. Conduct Investigations of Complex Problems 4. Problem Analysis for suitability of data structures. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	

Text Books:

1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014
2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014

Reference Books:

1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning, 2014
2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012
3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013
4. Data Structures using C - A M Tenenbaum, PHI, 1989
5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996

COMPUTER ORGANIZATION

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Subject Code	15CS34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives:			
This course will enable the students to			
<ul style="list-style-type: none"> • Explain the basic sub systems of a computer, their organization, structure and operation. • Illustrate the concept of programs as sequences of machine instructions. • Demonstrate different ways of communicating with I/O devices and standard I/O interfaces. • Describe memory hierarchy and concept of virtual memory. • Describe arithmetic and logical operations with integer and floating-point operands. • Illustrate organization of a simple processor, pipelined processor and other computing systems. 			
Module -1			Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions			10Hours
Module -2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.			10 Hours
Module – 3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.			10 Hours
Module-4			
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.			10 Hours
Module-5			

<p>Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.</p>	<p>10 Hours</p>
<p>Course outcomes: After studying this course, students will be able to:</p>	
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Design and analyse simple arithmetic and logical units. 	
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Life-Long Learning 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12) 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 	

UNIX AND SHELL PROGRAMMING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Illustrate the UNIX system architecture and use of basic Commands. • Use of editors and networking commands. • Demonstrate writing shell scripts. • Categorize, compare and make use of UNIX system calls. 			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			10Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			10Hours

Module – 3	
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>	10Hours
Module-4	
<p>Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.</p> <p>Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2</p>	10Hours
Module-5	
<p>Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.</p> <p>Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.</p> <p>Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1</p>	10Hours
Course outcomes:	

After studying this course, students will be able to:

- Explain UNIX system and use different commands.
- Write Shell scripts for certain functions on different subsystems.
- Demonstrate use of editors and Perl script writing

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Environment and Sustainability
3. Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

Reference Books:

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition , Wiley,2014.

DISCRETE MATHEMATICAL STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER – III

Subject Code	15CS36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • Provide theoretical foundations of computer science to perceive other courses in the programme. • Illustrate applications of discrete structures: logic, relations, functions, set theory and counting. • Describe different mathematical proof techniques, • Illustrate the use of graph theory in computer science. 			
Module -1			Teaching Hours
<p>Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,</p>			10Hours
Module -2			
<p>Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.</p>			10 Hours
Module – 3			
<p>Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.</p>			10 Hours
Module-4			
<p>The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,</p>			10 Hours
Module-5			
<p>Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes</p>			10 Hours

<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Application of different mathematical proofs techniques in proving theorems in the courses. • Compare graphs, trees and their applications.
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> 1. Engineering Knowledge 2. Problem Analysis 3. Conduct Investigations of Complex Problems 4. Design/Development of Solutions.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007. 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010. 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004. 5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)
SEMESTER - III

Laboratory Code	15CSL37	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enable students to get practical experience in design, assembly and evaluation/testing of

- Analog components and circuits including Operational Amplifier, Timer, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and registers using flip-flops.
- Synchronous and Asynchronous sequential circuits.
- A/D and D/A converters

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 20 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

Continued:

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.
6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.
9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

Study experiment

12. To study 4-bit ALU using IC-74181.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Use various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit.
- Design and demonstrate various combinational logic circuits.
- Design and demonstrate various types of counters and Registers using Flip-flops
- Use simulation package to design circuits.
- Understand the working and implementation of ALU.

Graduate Attributes (as per NBA)

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Modern Tool Usage

Conduction of Practical Examination:

1. All laboratory experiments (1 to 11 nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script.
4. Marks distribution:
 - a) For questions having part a only- Procedure + Conduction + Viva: **20 + 50 + 10 = 80 Marks**
 - b) For questions having part a and b
 - Part a- Procedure + Conduction + Viva: **10 + 35 + 05 = 50 Marks**
 - Part b- Procedure + Conduction + Viva: **10 + 15 + 05 = 30 Marks**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

DATA STRUCTURES LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2015 -2016)

SEMESTER - III

Laboratory Code	15CSL38	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 02

Course objectives:

This laboratory course enable students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- Asymptotic performance of algorithms.
- Linear data structures and their applications such as stacks, queues and lists
- Non-Linear data structures and their applications such as trees and graphs
- Sorting and searching algorithms

Descriptions (if any)

Implement all the experiments in C Language under Linux / Windows environment.

Laboratory Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following **Array** operations
 - a. Creating an Array of N Integer Elements
 - b. Display of Array Elements with Suitable Headings
 - c. Inserting an Element (**ELEM**) at a given valid Position (**POS**)
 - d. Deleting an Element at a given valid Position(**POS**)
 - e. Exit.Support the program with functions for each of the above operations.
2. Design, Develop and Implement a Program in C for the following operations on **Strings**
 - a. Read a main String (**STR**), a Pattern String (**PAT**) and a Replace String (**REP**)
 - b. Perform Pattern Matching Operation: Find and Replace all occurrences of **PAT** in **STR** with **REP** if **PAT** exists in **STR**. Report suitable messages in case **PAT** does not exist in **STR**Support the program with functions for each of the above operations. Don't use Built-in functions.
3. Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
 - a. **Push** an Element on to Stack
 - b. **Pop** an Element from Stack
 - c. Demonstrate how Stack can be used to check **Palindrome**
 - d. Demonstrate **Overflow** and **Underflow** situations on Stack
 - e. Display the status of Stack

f. Exit

Support the program with appropriate functions for each of the above operations

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
5. Design, Develop and Implement a Program in C for the following Stack Applications
 - a. Evaluation of **Suffix expression** with single digit operands and operators: +, -, *, /, %, ^
 - b. Solving **Tower of Hanoi** problem with **n** disks
6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
 - a. Insert an Element on to Circular QUEUE
 - b. Delete an Element from Circular QUEUE
 - c. Demonstrate **Overflow** and **Underflow** situations on Circular QUEUE
 - d. Display the status of Circular QUEUE
 - e. Exit

Support the program with appropriate functions for each of the above operations

Continued:

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: **USN, Name, Branch, Sem, PhNo**
 - a. Create a **SLL** of **N** Students Data by using **front insertion**.
 - b. Display the status of **SLL** and count the number of nodes in it
 - c. Perform Insertion / Deletion at End of **SLL**
 - d. Perform Insertion / Deletion at Front of **SLL(Demonstration of stack)**
 - e. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: **SSN, Name, Dept, Designation, Sal, PhNo**
 - a. Create a **DLL** of **N** Employees Data by using **end insertion**.
 - b. Display the status of **DLL** and count the number of nodes in it
 - c. Perform Insertion and Deletion at End of **DLL**
 - d. Perform Insertion and Deletion at Front of **DLL**
 - e. Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - f. Exit

<p>9. Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes</p> <ol style="list-style-type: none"> Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) <p>Support the program with appropriate functions for each of the above operations</p> <p>10. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers</p> <ol style="list-style-type: none"> Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 Traverse the BST in Inorder, Preorder and Post Order Search the BST for a given element (KEY) and report the appropriate message Exit <p>11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method <p>12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K → L as $H(K) = K \text{ mod } m$ (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Analyze and Compare various linear and non-linear data structures Code, debug and demonstrate the working nature of different types of data structures and their applications Implement, analyze and evaluate the searching and sorting algorithms Choose the appropriate data structure for solving real world problems
<p>Graduate Attributes (as per NBA)</p> <ol style="list-style-type: none"> Engineering Knowledge Problem Analysis Design/Development of Solutions Modern Tool Usage
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments (TWELVE nos) are to be included for practical examination. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80) Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate, solve and analyze engineering problems. • Apply numerical methods to solve ordinary differential equations. • Apply finite difference method to solve partial differential equations. • Perform complex analysis. • Interpret use of sampling theory. • Apply joint probability distribution and stochastic process. 			
Module 1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Picard’s method, Taylor’s series method, modified Euler’s method, Runge-Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order ordinary differential equations, Picard’s method, Runge-Kutta method of fourth order			10 Hours
Module 2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Picard’s method, Runge-Kutta method and Milne’s method. Special Functions: Bessel’s functions- basic properties, recurrence relations, orthogonality and generating functions. Legendre’s functions - Legendre’s polynomial, Rodrigue’s formula, problems.			10 Hours
Module 3			
Complex Variables: Function of a complex variable, limits, continuity, differentiability,. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem with proof and problems. Transformations: Conformal transformations, discussion of transformations: $w = z + iy$, $w = z^2$, $w = z + (1/z)$ and bilinear transformations.			10 Hours
Module 4			
Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.			10 Hours
Module 5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.			10 Hours

<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Use appropriate numerical methods to solve first and second order ordinary differential equations. • Use Bessel's and Legendre's function which often arises when a problem possesses axial and spherical symmetry, such as in quantum mechanics, electromagnetic theory, hydrodynamics and heat conduction. • State and prove Cauchy's theorem and its consequences including Cauchy's integral formula. • Compute residues and apply the residue theorem to evaluate integrals. • Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous statistical methods.
<p>Graduate Attributes</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-Long Learning • Conduct Investigations of Complex Problems
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006. 2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition. 2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013. 3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

SOFTWARE ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Outline software engineering principles and activities involved in building large software programs. • Identify ethical and professional issues and explain why they are of concern to software engineers. • Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. • Differentiate system models, use UML diagrams and apply design patterns. • Discuss the distinctions between validation testing and defect testing. • Recognize the importance of software maintenance and describe the intricacies involved in software evolution. • Apply estimation techniques, schedule project activities and compute pricing. • Identify software quality parameters and quantify software using measurements and metrics. • List software quality standards and outline the practices involved. • Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility. 			
Module 1			Teaching Hours
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities. Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).			12 Hours
Module 2			
System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-Oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).			11 Hours
Module 3			
Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695). Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).			9 Hours

Module 4	
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)	10 Hours
Module 5	
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “ The SCRUM Primer, Ver 2.0 ”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):	8 Hours
Course Outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Use the techniques, skills, and modern engineering tools necessary for engineering practice • Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Project Management and Finance • Conduct Investigations of Complex Problems • Modern Tool Usage • Ethics 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012. (Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24) 2. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf 	
Reference Books:	
<ol style="list-style-type: none"> 1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India 	
Web Reference for eBooks on Agile:	
<ol style="list-style-type: none"> 1. http://agilemanifesto.org/ 2. http://www.jamesshore.com/Agile-Book/ 	

DESIGN AND ANALYSIS OF ALGORITHMS			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain various computational problem solving techniques. • Apply appropriate method to solve a given problem. • Describe various methods of algorithm analysis. 			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic			10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education) 	

MICROPROCESSORS AND MICROCONTROLLERS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Make familiar with importance and applications of microprocessors and microcontrollers
- Expose architecture of 8086 microprocessor and ARM processor
- Familiarize instruction set of ARM processor

Module 1	Teaching Hours
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<p>The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code.</p> <p>Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7</p>	10 Hours
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Module 2	Teaching Hours
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<p>x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment.</p> <p>Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2</p>	10 Hours
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Module 3	Teaching Hours
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<p>Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255.</p> <p>Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4</p>	10 Hours
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Module 4	Teaching Hours
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<p>Microprocessors versus Microcontrollers, ARM Embedded Systems :The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions</p> <p>Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5</p>	10 Hours
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Module 5	Teaching Hours
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<p>Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.</p> <p>Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)</p>	10 Hours
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Course Outcomes: After studying this course, students will be able to

- Differentiate between microprocessors and microcontrollers
- Design and develop assembly language code to solve problems
- Gain the knowledge for interfacing various devices to x86 family and ARM processor
- Demonstrate design of interrupt routines for interfacing devices

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions

Question paper pattern:

The question paper will have ten questions.
 There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

OBJECT ORIENTED CONCEPTS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Learn fundamental features of object oriented language and JAVA • Set up Java JDK environment to create, debug and run simple Java programs. • Create multi-threaded programs and event handling mechanisms. • Introduce event driven Graphical User Interface (GUI) programming using applets and swings. 			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			10 Hours
Module 2			
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			10 Hours
Module 3			
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			10 Hours
Module 4			
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			10 Hours
Module 5			
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting;			10 Hours

Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using Applets and swings. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Programming Knowledge • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30) 	
Reference Book:	
<ol style="list-style-type: none"> 1. Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 	
Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.	

DATA COMMUNICATION			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – IV			
Subject Code	15CS46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data. • Explain with the basics of data communication and various types of computer networks; • Illustrate TCP/IP protocol suite and switching criteria. • Demonstrate Medium Access Control protocols for reliable and noisy channels. • Expose wireless and wired LANs along with IP version. 			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • Enumerate the layers of the OSI model and TCP/IP functions of each layer. • Make out the different types of network devices and their functions within a network 			

- Demonstrate the skills of subnetting and routing mechanisms.

Graduate Attributes

1. Engineering Knowledge
2. Design Development of solution(Partly)
3. Modern Tool Usage
4. Problem Analysis

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CSL47	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Design and implement various algorithms in JAVA • Employ various design strategies for problem solving. • Measure and compare the performance of different algorithms. 			
Description			
Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.			
Experiments			
1	A	Create a Java class called <i>Student</i> with the following details as variables within it. <ul style="list-style-type: none"> (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.	
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.	
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.	
3	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.	
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	
4	Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000 and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.		

5	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.
To generate the data set use random number generator function.
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 20 + 50 + 10 (80). Change of experiment is allowed only once and marks allotted to the procedure

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CSL48	IA Marks	20
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide practical exposure to the students on microprocessors, design and coding knowledge on 80x86 family/ARM. To give the knowledge and practical exposure on connectivity and execute of interfacing devices with 8086/ARM kit like LED displays, Keyboards, DAC/ADC, and various other devices.

Description

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8.
 - a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
 - b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Learn 80x86 instruction sets and gains the knowledge of how assembly language works.
- Design and implement programs written in 80x86 assembly language
- Know functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Modern Tool Usage
- Conduct Investigations of Complex Problems
- Design/Development of Solutions

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- PART –B: Procedure + Conduction + Viva: 10 + 25 +05 (40)
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS51	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the principles of management, organization and entrepreneur. • Discuss on planning, staffing, ERP and their importance • Infer the importance of intellectual property rights and relate the institutional support 			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline 			

their importance in entrepreneurship

- Utilize the resources available effectively through ERP
- Make use of IPRs and institutional support in entrepreneurship

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS52	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstration of application layer protocols • Discuss transport layer services and understand UDP and TCP protocols • Explain routers, IP and Routing Algorithms in network layer • Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard • Illustrate concepts of Multimedia Networking, Security and Network Management 			
Module – 1			Teaching Hours
<p>Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.</p> <p>T1: Chap 2</p>			10 Hours
Module – 2			
<p>Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.</p> <p>T1: Chap 3</p>			10 Hours
Module – 3			
<p>The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing,</p>			10 Hours

Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7	
Module – 4	
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE,Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	10 Hours
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case studies: : Netflix, You Tube and Kankan. Network Support for Multimedia: Dimensioning Best-Effort Networks, Providing Multiple Classes of Service, Diffserv, Per-Connection Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7: 7.1,7.2,7.5	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Recognize transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard • Describe Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
<ol style="list-style-type: none"> 1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning 	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS53	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Provide a strong foundation in database concepts, technology, and practice. • Practice SQL programming through a variety of database problems. • Demonstrate the use of concurrency and transactions in database • Design and build database applications for real world problems. 			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal			10 Hours

Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6	
Module – 5	
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design and build simple database systems • Develop application to interact with databases. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
Reference Books:	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS54	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce core concepts in Automata and Theory of Computation • Identify different Formal language Classes and their Relationships • Design Grammars and Recognizers for different formal languages • Prove or disprove theorems in automata theory using their properties • Determine the decidability and intractability of Computational problems 			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages,			10 Hours

<p>Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation • Learn how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models). • Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers. • Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness. • Classify a problem with respect to different models of Computation. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013 2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013 2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013 3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013 4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998 5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012 6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012. 	

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS551	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the concepts involved in Object-Oriented modelling and their benefits. • Demonstrate concept of use-case model, sequence model and state chart model for a given problem. • Explain the facets of the unified process approach to design and build a Software system. • Translate the requirements into implementation for Object Oriented design. • Choose an appropriate design pattern to facilitate development procedure. 			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours

Module – 5	
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Describe the concepts of object-oriented and basic class modelling. • Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. • Choose and apply a befitting design pattern for the given problem. 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005 2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005. 3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007. 2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007. 3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013 	

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS552	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Differentiate the various testing techniques. • Analyze the problem and derive suitable test cases. • Apply suitable technique for designing of flow graph. • Explain the need for planning and monitoring a process. 			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the			8 Hours

process, the quality team. T2: Chapter 17, 20.	
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations. T2: Chapter 21 & 22, T1 : Chapter 12 & 13	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3 rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.	
Reference Books:	
1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2 nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press.	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CS553	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Identify the need for advanced Java concepts like Enumerations and Collections
- Construct client-server applications using Java socket API
- Make use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs
- Demonstrate the use of JavaBeans to develop component-based Java software

Module – 1

Teaching Hours

Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

8 Hours

Module – 2

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

8 Hours

Module – 3

String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder

8 Hours

Text Book 1: Ch 15

Module – 4	
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects Text Book 1: Ch 31 Text Book 2: Ch 11	8 Hours
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – V			
Subject Code	15CS554	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain principles of algorithms analysis approaches • Compare and contrast a number theoretic based strategies. • Describe complex signals and data flow in networks • Apply the computational geometry criteria. 			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each			

module.

Text Books:

1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990
2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL57	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate operation of network and its management commands
- Simulate and demonstrate the performance of GSM and CDMA
- Implement data link layer and transport layer protocols.

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.

- Implement, analyze and evaluate networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 80
Part A: 10+25+5 =40
Part B: 10+25+5 =40
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – V

Subject Code	15CSL58	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(<u>Book_id</u>, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(<u>Book_id</u>, Author_Name) PUBLISHER(<u>Name</u>, Address, Phone) BOOK_COPIES(<u>Book_id</u>, <u>Branch_id</u>, No-of_Copies) BOOK_LENDING(<u>Book_id</u>, <u>Branch_id</u>, <u>Card_No</u>, Date_Out, Due_Date) LIBRARY_BRANCH(<u>Branch_id</u>, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(<u>Salesman_id</u>, Name, City, Commission) CUSTOMER(<u>Customer_id</u>, Cust_Name, City, Grade, Salesman_id) ORDERS(<u>Ord_No</u>, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average.

	<ol style="list-style-type: none"> 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
3	<p>Consider the schema for Movie Database:</p> <p>ACTOR(<u>Act_id</u>, Act_Name, Act_Gender)</p> <p>DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone)</p> <p>MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id)</p> <p>MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role)</p> <p>RATING(<u>Mov_id</u>, Rev_Stars)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database:</p> <p>STUDENT(<u>USN</u>, SName, Address, Phone, Gender)</p> <p>SEMSEC(<u>SSID</u>, Sem, Sec)</p> <p>CLASS(<u>USN</u>, <u>SSID</u>)</p> <p>SUBJECT(<u>Subcode</u>, Title, Sem, Credits)</p> <p>IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database:</p> <p>EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo)</p> <p>DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate)</p> <p>DLOCATION(<u>DNo</u>, <u>DLoc</u>)</p> <p>PROJECT(<u>PNo</u>, PName, PLocation, DNo)</p> <p>WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.

	<ol style="list-style-type: none"> 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
<p>Part B: Mini project</p>	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Create, Update and query on the database. • Demonstrate the working of different concepts of DBMS • Implement, analyze and evaluate the project developed for an application. 	
<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 30 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 10 + 35 + 5 = 50 Marks b) Part B: Demonstration + Report + Viva voce = 15 + 10 + 05 = 30 Marks 7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS61	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the concepts of Cyber security • Illustrate key management issues and solutions. • Familiarize with Cryptography and very essential algorithms • Introduce cyber Law and ethics to be followed. 			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber			10 Hours

regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Discuss cryptography and its need to various applications • Design and develop simple cryptography algorithms • Understand cyber security and need cyber Law 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015 2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition 3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013 4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning 	

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS62	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain hardware, software and OpenGL Graphics Primitives. • Illustrate interactive computer graphic using the OpenGL. • Design and implementation of algorithms for 2D graphics Primitives and attributes. • Demonstrate Geometric transformations, viewing on both 2D and 3D objects. • Infer the representation of curves, surfaces, Color and Illumination models 			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle generation algorithms (Bresenham's). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong			10 Hours

model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3	
Module – 4	
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions. Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14	10 Hours
Module – 5	
Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions. Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10 Text-2:Chapter 3: 3-1 to 3.11: Input& interaction	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Decide suitable hardware and software for developing graphics packages using OpenGL. 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M M Raiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS63	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define System Software such as Assemblers, Loaders, Linkers and Macroprocessors • Familiarize with source file, object file and executable file structures and libraries • Describe the front-end and back-end phases of compiler and their importance to students 			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Utilize lex and yacc tools for implementing different concepts of system software 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS64	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Introduce concepts and terminology used in OS • Explain threading and multithreaded systems • Illustrate process synchronization and concept of Deadlock • Introduce Memory and Virtual memory management, File system and storage techniques 			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			
Secondary Storage Structures, Protection: Mass storage structures; Disk			10 Hours

<p>structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Apply suitable techniques for management of different resources • Use processor, memory, storage and file system commands • Realize the different concepts of OS in platform of usage through case studies 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
<p>Reference Books</p>	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013. 3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS651	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define multi-dimensional data models. • Explain rules related to association, classification and clustering analysis. • Compare and contrast between different classification and clustering algorithms 			
Module – 1			Teaching Hours
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify data mining problems and implement the data warehouse • Write association rules for a given data pattern. • Choose between classification and clustering solution. 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS652	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To Learn How to add functionality to designs while minimizing complexity. • What code qualities are required to maintain to keep code flexible? • To Understand the common design patterns. • To explore the appropriate patterns for design problems 			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Be aware of code qualities needed to keep code flexible • Experience core design principles and be able to assess the quality of a design with respect to these principles. • Capable of applying these principles in the design of object oriented systems. • Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. • Be able to select and apply suitable patterns in specific contexts 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnath rammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS653	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Formulate optimization problem as a linear programming problem. • Solve optimization problems using simplex method. • Formulate and solve transportation and assignment problems. • Apply game theory for decision making problems. 			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel’s Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Select and apply optimization techniques for various problems. • Model the given problem as transportation and assignment problem and solve. • Apply game theory for decision support system. 			

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, Kedar Nath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CS654	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain distributed system, their characteristics, challenges and system models. • Describe IPC mechanisms to communicate between distributed objects • Illustrate the operating system support and File Service architecture in a distributed system • Analyze the fundamental concepts, algorithms related to synchronization. 			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern:			
The question paper will have TEN questions.			

There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5th Edition, Pearson Publications, 2009

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. Sunita Mahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15CSL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To make students familiar with Lexical Analysis and Syntax Analysis phases of Compiler Design and implement programs on these phases using LEX & YACC tools and/or C/C++/Java
- To enable students to learn different types of CPU scheduling algorithms used in operating system.
- To make students able to implement memory management - page replacement and deadlock handling algorithms

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use **data input file** where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid **arithmetic expression**. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate **arithmetic expression** involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with **b** preceded by **n a's** using the grammar $a^n b$ (note: input **n** value)
3. Design, develop and implement YACC/C program to construct **Predictive / LL(1) Parsing Table** for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: **abba\$**
4. Design, develop and implement YACC/C program to demonstrate **Shift Reduce Parsing** technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: **id + id * id**.
5. Design, develop and implement a C/Java program to generate the machine code using

Triples for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$

6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the resulting program into a separate file.
b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (C program) file.
7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Evaluate different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **20 + 50 + 10 (80)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VI			
Subject Code	15CSL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Demonstrate simple algorithms using OpenGL Graphics Primitives and attributes. • Implementation of line drawing and clipping algorithms using OpenGL functions • Design and implementation of algorithms Geometric transformations on both 2D and 3D objects. 			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham’s line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic: sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			

Course outcomes: The students should be able to:

- Apply the concepts of computer graphics
- Implement computer graphics applications using OpenGL
- Animate real world problems using OpenGL

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
 - b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M M Raikar, Computer Graphics using OpenGL, Phillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Infer Object Oriented Programming capabilities of PHP
- Examine JavaScript frameworks such as jQuery and Backbone

Module – 1

Teaching Hours

Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

10 Hours

Module – 2

HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

10 Hours

Module – 3

JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions

10 Hours

Module – 4

PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling

10 Hours

Module – 5

Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.

10 Hours

Course Outcomes: After studying this course, students will be able to

- Adapt HTML and CSS syntax and semantics to build web pages.

- Construct and visually format tables and forms using HTML and CSS
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- Appraise the principles of object oriented development using PHP
- Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS72	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe computer architecture. • Measure the performance of architectures in terms of right parameters. • Summarize parallel architecture and the software used for them. 			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder			10 Hours

Buffer, Register Renaming ,Tomasulo's Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts of parallel computing and hardware technologies • Compare and contrast the parallel architectures • Illustrate parallel programming concepts 	
Question paper pattern The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: <ol style="list-style-type: none"> 1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015 	
Reference Books: <ol style="list-style-type: none"> 1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013 	

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS73	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Module – 1 **Teaching Hours**

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **10 Hours**
Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.
Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7

Module – 2

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **10 Hours**
Text Book1, Sections: 3.1-3.7

Module – 3

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **08 Hours**
Text book 1, Sections: 4.1 – 4.6

Module – 4

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm **10 Hours**
Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12

Module – 5

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. **12 Hours**
Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,
Reinforcement Learning: Introduction, Learning Task, Q Learning
Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3

Course Outcomes:After studying this course, students will be able to

- Identify the problems for machine learning. And select the either supervised,

unsupervised or reinforcement learning.

- Explain theory of probability and statistics related to machine learning
- Investigate concept learning, ANN, Bayes classifier, k nearest neighbor, Q,

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

<p style="text-align: center;">NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII</p>			
Subject Code	15CS741	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Learn the techniques in natural language processing. • Be familiar with the natural language generation. • Be exposed to Text Mining. • Understand the information retrieval techniques 			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours

Module – 5	
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the natural language text. • Generate the natural language. • Do Text mining. • Apply information retrieval techniques. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008. 2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008. 2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995. 3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000. 	

CLOUD COMPUTING AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CS742	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamentals of cloud computing • Illustrate the cloud application programming and aneka platform • Contrast different cloud platforms used in industry 			
Module – 1			Teaching Hours
<p>Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka</p> <p>Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V</p>			8 Hours
Module – 2			8 Hours
<p>Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects</p> <p>Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools</p>			8 Hours
Module – 3			8 Hours
<p>Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix</p>			8 Hours

Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Describe the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS743	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Analyze the cryptographic processes. • Summarize the digital security process. • Indicate the location of a security process in the given system 			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:
<ol style="list-style-type: none">1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin Oxford Scholarship Online: December 2013
Reference Books:
<ol style="list-style-type: none">1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS744	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain the fundamental design of the unix operating system • Familiarize with the systems calls provided in the unix environment • Design and build an application/service over the unix operating system 			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores.			8 Hours

Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Ability to understand and reason out the working of Unix Systems • Build an application/service over a Unix system. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. 2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005. 2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987. 3. Unix Internals - Uresh Vahalia, Pearson Education, 2001. 	

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS751	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Familiarize with the basic concept of soft computing and intelligent systems • Compare with various intelligent systems • Analyze the various soft computing techniques 			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:
1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015
Reference Books:
1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 2011

COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS752	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Review image processing techniques for computer vision • Explain shape and region analysis • Illustrate Hough Transform and its applications to detect lines, circles, ellipses • Contrast three-dimensional image analysis techniques, motion analysis and applications of computer vision algorithms 			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining			8 Hours

Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013. 	

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS753	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the fundamental concepts in image processing • Evaluate techniques followed in image enhancements • Illustrate image segmentation and compression algorithms 			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

Reference Books:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VII			
Subject Code	15CS754	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate storage architectures, • Define backup, recovery, disaster recovery, business continuity, and replication • Examine emerging technologies including IP-SAN • Understand logical and physical components of a storage infrastructure • Identify components of managing and monitoring the data center • Define information security and identify different storage virtualization technologies 			
Module – 1			Teaching Hours
Storage System Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host (Compute), Connectivity, Storage. Data Protection: RAID: RAID Implementation Methods, RAID Techniques, RAID Levels, RAID Impact on Disk Performance. Intelligent Storage Systems: Components of Intelligent Storage System, Storage Provisioning. Text Book-1 Ch1: 1.2 to 1.4, Ch2: 2.1, 2.3 to 2.5, Ch3: 3.1, 3.3 to 3.5, Ch4: 4.1 and 4.2			8 Hours
Module – 2			
Storage Networking Technologies Fibre Channel Storage Area Networks: Components of FC SAN, FC connectivity, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network Attached Storage: Components of NAS, NAS I/O Operation, NAS File-Sharing Protocols, File-Level Virtualization, Object-Based Storage and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage. Text Book-1 Ch5: 5.3, 5.4, 5.6, 5.9 to 5.11, Ch6: 6.1 to 6.3, Ch7: 7.4, 7.5, 7.7 and 7.9 Ch8: 8.1, 8.2 and 8.4			8 Hours
Module – 3			
Backup, Archive and Replication Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Local Replication Technologies, Local Replication in a Virtualized Environment. Remote Replication: Remote Replication Technologies, Three-Site Replication, Remote Replication and			8 Hours

Migration in a Virtualized Environment.	
Text Book-1 Ch10: 10.5, 10.8, 10.10 to 10.13, Ch11: 11.1, 11.2, 11.4 and 11.8, Ch12: 12.2, 12.3 and 12.5	
Module – 4	
Cloud Computing and Virtualization Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges and Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, High Availability for Virtualization Appliances, Appliances for Mass Consumption. Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications.	8 Hours
Text Book-1 Ch13: 13.1 to 13.8. Text Book-2 Ch9: 9.1 to 9.5 Ch13: 13.1 to 13.3	
Module – 5	
Securing and Managing Storage Infrastructure Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. Managing the Storage Infrastructure Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle management, Storage Tiering.	8 Hours
Text Book-1 Ch14: 14.1 to 14.5, Ch15: 15.1 to 15.3, 15.5 and 15.6	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL76	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:
NIL
Course outcomes: The students should be able to:
<ol style="list-style-type: none"> 1. Understand the implementation procedures for the machine learning algorithms. 2. Design Java/Python programs for various Learning algorithms. 3. Apply appropriate data sets to the Machine Learning algorithms. 4. Identify and apply Machine Learning algorithms to solve real world problems.
Conduction of Practical Examination:
<ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script • Marks distribution: Procedure + Conduction + Viva: 20 + 50 +10 (80) <p>Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.</p>

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VII

Subject Code	15CSL77	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

1. Design and develop static and dynamic web pages.
2. Familiarize with Client-Side Programming, Server-Side Programming, Active server Pages.
3. Learn Database Connectivity to web applications.

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.

9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
- Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.
 - Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.I as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

- In the examination each student picks one question from part A.
- A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
- The team must submit a brief project report (15-20 pages) that must include the following
 - Introduction
 - Requirement Analysis
 - Software Requirement Specification
 - Analysis and Design
 - Implementation
 - Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Have a good understanding of Web Application Terminologies, Internet Tools other web services.
- Learn how to link and publish web sites

Conduction of Practical Examination:

- All laboratory experiments from part A are to be included for practical examination.

2. Mini project has to be evaluated for 30 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: $10 + 35 + 5 = 50$ Marks
 - b) Part B: Demonstration + Report + Viva voce = $15 + 10 + 05 = 30$ Marks

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

INTERNET OF THINGS TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Assess the genesis and impact of IoT applications, architectures in real world. • Illustrate diverse methods of deploying smart objects and connect them to network. • Compare different Application protocols for IoT. • Infer the role of Data Analytics and Security in IoT. • Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry. 			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,			10 Hours

Smart City Security Architecture, Smart City Use-Case Examples.	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. • Appraise the role of IoT protocols for efficient network communication. • Elaborate the need for Data Analytics and Security in IoT. • Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) 2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017 	
Reference Books:	
<ol style="list-style-type: none"> 1. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands -on- Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) 2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224) 	

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand Hadoop Distributed File system and examine MapReduce Programming • Explore Hadoop tools and manage Hadoop with Ambari • Appraise the role of Business intelligence and its applications across industries • Assess core data mining techniques for data analytics • Identify various Text Mining techniques 			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Master the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			

2. Anil Maheshwari, "**Data Analytics**", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180

Reference Books:

- 1) Tom White, "**Hadoop: The Definitive Guide**", 4th Edition, O'Reilly Media,
- 2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "**Professional Hadoop Solutions**", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071
- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

**HIGH PERFORMANCE COMPUTING [As
per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CS831	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

Module – 1

Teaching Hours

Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)

10 Hours

Module – 2

High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built

10 Hours

Module – 3

Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques

10 Hours

Module – 4

Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)

10 Hours

Module – 5

Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks

10 Hours

Course outcomes: The students should be able to:

- Illustrate the key factors affecting performance of CSE applications, and
- Make mapping of applications to high-performance computing systems, and

- Apply hardware/software co-design for achieving performance on real-world applications

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

MODERN INTERFACE DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII			
Subject Code	15CS832	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
<ul style="list-style-type: none"> • Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002. 			

Reference Books:

3. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
4. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – VIII			
Subject Code	15CS833	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To understand the need for interoperable network management. • To learn to the concepts and architecture behind standards based network management. • To understand the concepts and terminology associated with SNMP and TMN • To understand network management as a typical distributed application 			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			8 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			
Module – 3			8 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			
Module – 4			8 Hours
Broadband Access Networks, Broadband Access Technology; HFCT			

<p>Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles</p>	
<p>Module – 5</p>	
<p>Network Management Applications: Configuration Management- Network 8 Hours Provisioning, Inventory Management, Network Topology, Fault Management-Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p>	
<p>1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books:</p>	
<p>1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

SYSTEM MODELLING AND SIMULATION
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	15CS834	IA Marks	20
Number of Lecture Hours/Week	3	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain the basic system concept and definitions of system;
- Discuss techniques to model and to simulate various systems;
- Analyze a system and to make use of the information to improve the performance.

Module – 1

Teaching Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. **General Principles, Simulation Software:** Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling

10 Hours

Module – 2

Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions.
Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont..., Steady-state behavior of M /G/1 queue, Networks of queues,

10 Hours

Module – 3

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, **Random-Variate Generation:** ,Inverse transform technique Acceptance-Rejection technique.

10 Hours

Module – 4

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.
Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, **Contd..**

10 Hours

Module – 5

Measures of performance and their estimation, Output analysis for terminating simulations Continued..., Output analysis for steady-state simulations.
Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of

10 Hours

simulation models, Calibration and validation of models, Optimization via Simulation.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the system concept and apply functional modeling method to model the activities of a static system • Describe the behavior of a dynamic system and create an analogous model for a dynamic system; • Simulate the operation of a dynamic system and make improvement according to the simulation results. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007 	

INTERNSHIP / PROFESSIONAL PRACTISE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – VIII

Subject Code	15CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Evaluation of Internship :

**PROJECT WORK PHASE II [As per Choice Based Credit System
(CBCS) scheme] (Effective from the academic year 2016 -2017)
SEMESTER – VIII**

Subject Code	15CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 05

Course objectives: This course will enable students to

Description (If any):

Course outcomes: The students should be able to:

Conduction of Practical Examination:

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – VIII

Subject Code	15CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 02

Course objectives: This course will enable students to

•

Description:

•

Course outcomes: The students should be able to:

•

Evaluation of seminar:

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

III SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics - III	Maths	04		03	60	40	100	4
2	17CS32	Analog and Digital Electronics	CS/IS	04		03	60	40	100	4
3	17CS33	Data Structures and Applications	CS/IS	04		03	60	40	100	4
4	17CS34	Computer Organization	CS/IS	04		03	60	40	100	4
5	17CS35	Unix and Shell Programming	CS/IS	03		03	60	40	100	3
6	17CS36	Discrete Mathematical Structures	CS/IS	04		03	60	40	100	4
7	17CSL37	Analog and Digital Electronics Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL38	Data Structures Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1.Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

IV SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics - IV	Maths	04		03	60	40	100	4
2	17CS42	Object Oriented Concepts	CS/IS	03		03	60	40	100	3
3	17CS43	Design and Analysis of Algorithms	CS/IS	04		03	60	40	100	4
4	17CS44	Microprocessors and Microcontrollers	CS/IS	04		03	60	40	100	4
5	17CS45	Software Engineering	CS/IS	04		03	60	40	100	4
6	17CS46	Data Communication	CS/IS	04		03	60	40	100	4
7	17CSL47	Design and Analysis of Algorithm Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL48	Microprocessors Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

1	17MATDIP41	Additional Mathematics –II	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

V SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS51	Management and Entrepreneurship for IT Industry	CS/IS	04		03	60	40	100	4
2	17CS52	Computer Networks	CS/IS	04		03	60	40	100	4
3	17CS53	Database Management System	CS/IS	04		03	60	40	100	4
4	17CS54	Automata theory and Computability	CS/IS	04		03	60	40	100	4
5	17CS55x	Professional Elective-1	CS/IS	03		03	60	40	100	3
6	17CS56x	Open Elective-1	CS/IS	03		03	60	40	100	3
7	17CSL57	Computer Network Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL58	DBMS Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory: 22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-1		Open Elective – 1*** (List offered by CSE Board only)	
17CS553	Advanced JAVA and J2EE	17CS564	Dot Net framework for application development;

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre – requisite knowledge.
- The candidate has studied similar content course during previous semesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s). Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination 2017-2018 Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VI SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS61	Cryptography, Network Security and Cyber Law	CS/IS	04		03	60	40	100	4
2	17CS62	Computer Graphics and Visualization	CS/IS	04		03	60	40	100	4
3	17CS63	System Software and Compiler Design	CS/IS	04		03	60	40	100	4
4	17CS64	Operating Systems	CS/IS	04		03	60	40	100	4
5	17CS65x	Professional Elective-2	CS/IS	03		03	60	40	100	3
6	17CS66x	Open Elective-2	CS/IS	03		03	60	40	100	3
7	17CSL67	System Software and Operating System Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSL68	Computer Graphics Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory:22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-2		Open Elective – 2*** (List offered by CSE Board only)	
17CS651	Data Mining and Data Warehousing	17CS664	Python Application Programming

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre – requisite knowledge.
- The candidate has studied similar content course during previous semesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s). Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS71	Web Technology and its applications	CS/IS	04		03	60	40	100	4
2	17CS72	Advanced Computer Architectures	CS/IS	04		03	60	40	100	4
3	17CS73	Machine Learning	CS/IS	04		03	60	40	100	4
4	17CS74x	Professional Elective 3	CS/IS	03		03	60	40	100	3
5	17CS75x	Professional Elective 4	CS/IS	03		03	60	40	100	3
6	17CSL76	Machine Learning Laboratory	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17CSL77	Web Technology Laboratory with mini project	CS/IS	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17CSP78	Project Work Phase-I + Project work Seminar	CS/IS		03	--	--	100	100	2
TOTAL				Theory:18 hours Practical and Project: 09 hours		21	420	380	800	24

Professional Elective-3		Professional Elective-4	
17CS742	Cloud Computing and its Applications	17CS754	Storage Area Networks

1. Project Phase – I and Project Seminar: Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination 2017-2018 Choice Based Credit System (CBCS)

B.E: Computer Science and Engineering

VIII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17CS81	Internet of Things and Applications	CS/IS	4	-	3	60	40	100	4
2	17CS82	Big Data Analytics	CS/IS	4	-	3	60	40	100	4
3	17CS83X	Professional Elective-5	CS/IS	3	-	3	60	40	100	3
4	17CS84	Internship/ Professional Practice	CS/IS	Industry Oriented		3	50	50	100	2
5	17CSP85	Project Work-II	CS/IS	-	6	3	100	100	200	6
6	17CSS86	Seminar	CS/IS	-	4	-	-	100	100	1
TOTAL				Theory: 11 hours Project and Seminar: 10 hours		15	330	370	700	20

Professional Elective -5	
17CS834	System Modeling and Simulation

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period.

ENGINEERING MATHEMATICS-III
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17MAT31	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			10Hours
Module -2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			10 Hours
Module – 3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.			10 Hours
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's $(1/3)^{th}$ and $(3/8)^{th}$ rules, Weddle's rule (without proof) – Problems.			10 Hours
Module-5			
Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems.			10 Hours
Course outcomes:			

After Studying this course, students will be able to

- Know the use of periodic signals and Fourier series to analyze circuits and system communications.
- Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.
- Employ appropriate numerical methods to solve algebraic and transcendental equations.
- Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.
- Determine the extremals of functionals and solve the simple problems of the calculus of variations.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B. S. Grewal, " Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.
2. B.V. Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.

Reference Books:

1. N. P. Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition.
2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley.
3. H. K Dass and Er. Rajnish Verma , "Higher Engineering Mathematics", S. Chand, 1st ed.

ANALOG AND DIGITAL ELECTRONICS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER - III

Subject Code	17CS32	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
<p>Field Effect Transistors: Junction Field Effect Transistors, MOSFETs, Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. Introduction to Operational Amplifier: Ideal v/s practical Opamp, Performance Parameters, Operational Amplifier Application Circuits: Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To-Current Converter.</p> <p>Text book 1:- Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1.Ch13: 13.10.Ch 16: 16.3, 16.4. Ch 17: 7.12, 17.14, 17.15, 17.18, 17.19, 17.20, 17.21.)</p>			10 Hours
Module -2			
<p>The Basic Gates: Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.</p> <p>Text book 2:- Ch2: 2.4, 2.5. Ch3: 3.2 to 3.11.</p>			10 Hours
Module – 3			
<p>Data-Processing Circuits: Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit Flip- Flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs.</p> <p>Text book 2:- Ch 4:- 4.1 to 4.9, 4.11, 4.12, 4.14.Ch6:-6.7, 6.10.Ch8:- 8.1 to 8.5.</p>			10 Hours
Module-4			
<p>Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.</p> <p>(Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4)</p>			10 Hours

Module-5	
<p>Counters: Decade Counters, Presetable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.</p> <p>Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10</p>	10 Hours
<p>Course outcomes: After Studying this course, students will be able to</p>	
<ul style="list-style-type: none"> • Explain the operation of JFETs and MOSFETs , Operational Amplifier circuits and their application • Explain Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine McClusky technique. • Demonstrate Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors, working of Latches, Flip-Flops, Designing Registers, Counters, A/D and D/A Converters • Design of Counters, Registers and A/D & D/A converters 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012. 2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005. 2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010. 3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008. 	

DATA STRUCTURES AND APPLICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER - III			
Subject Code	17CS33	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS - 04			
Module -1			Teaching Hours
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples. Text 1: Ch 1: 1.2, Ch2: 2.2 -2.7 Text 2: Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14 Ref 3: Ch 1: 1.4			10 Hours
Module -2			
Stacks and Queues Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples. Text 1: Ch3: 3.1 -3.7 Text 2: Ch6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13			10 Hours
Module – 3			
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples Text 1: Ch4: 4.1 -4.8 except 4.6 Text 2: Ch5: 5.1 – 5.10			10 Hours

Module-4	
<p>Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples</p> <p>Text 1: Ch5: 5.1 –5.5, 5.7</p> <p>Text 2: Ch7: 7.1 – 7.9</p>	10 Hours
Module-5	
<p>Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing</p> <p>Text 1: Ch6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3</p> <p>Text 2: Ch8: 8.1 – 8.7, Ch 9:9.1-9.3,9.7,9.9</p> <p>Reference 2: Ch 16: 16.1 - 16.7</p>	10 Hours
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Explain different types of data structures, operations and algorithms • Apply searching and sorting operations on files • Make use of stack, Queue, Lists, Trees and Graphs in problem solving. • Develop all data structures in a high-level language for problem solving. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press,2014 2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Data Structures: A Pseudo-code approach with C –Gilberg & Forouzan, 2nd edition, Cengage Learning,2014 2. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012 3. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013 4. Data Structures using C - A M Tenenbaum, PHI, 1989 5. Data Structures and Program Design in C - Robert Kruse, 2nd edition, PHI, 1996 	

COMPUTER ORGANIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER - III			
Subject Code	17CS34	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions			10Hours
Module -2			
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.			10 Hours
Module – 3			
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.			10 Hours
Module-4			
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.			10 Hours
Module-5			
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Pipelining, Embedded Systems and Large Computer Systems: Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, The structure of General-Purpose Multiprocessors.			10 Hours
Course outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Explain the basic organization of a computer system. • Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. • Illustrate hardwired control and micro programmed control. pipelining, embedded and other computing systems. • Build simple arithmetic and logical units. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12)

Reference Books:

1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.

UNIX AND SHELL PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17CS35	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module -1			Teaching Hours
<p>Introduction, Brief history. Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.</p> <p>Topics from chapter 2 , 3 and 15 of text book 1,chapter 1 from text book 2</p>			08 Hours
Module -2			
<p>Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.</p> <p>Topics from chapters 4, 5 and 6 of text book 1</p>			08 Hours
Module – 3			
<p>The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.</p> <p>The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions.</p> <p>Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9 ,10 of text book 2</p>			08 Hours

Module-4	
Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.	08 Hours
Topics from chapter 11, 12, 14 of text book 1,chapter 17 from text book2	
Module-5	
Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file.. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example. Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @- variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.	08 Hours
Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1	
Course outcomes:	
After studying this course, students will be able to: <ul style="list-style-type: none"> • Explain UNIX system and use different commands. • Compile Shell scripts for certain functions on different subsystems. • Demonstrate use of editors and Perl script writing 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill 2. Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition. 2009. 	
Reference Books:	
<ol style="list-style-type: none"> 1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education. 2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2ndEdition , Wiley,2014. 	

DISCRETE MATHEMATICAL STRUCTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – III

Subject Code	17CS36	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module -1			Teaching Hours
Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems,			10Hours
Module -2			
Properties of the Integers: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Principles of Counting. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition,.			10 Hours
Module – 3			
Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.			10 Hours
Module-4			
The Principle of Inclusion and Exclusion: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients,			10 Hours
Module-5			
Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes			10 Hours
Course outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Make use of propositional and predicate logic in knowledge representation and truth verification. • Demonstrate the application of discrete structures in different fields of computer science. • Solve problems using recurrence relations and generating functions. • Apply different mathematical proofs, techniques in proving theorems. • Compare graphs, trees and their applications. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, Pearson Education. 2004. (Chapter 3.1, 3.2, 3.3, 3.4, Appendix 3, Chapter 2, Chapter 4.1, 4.2, Chapter 5.1 to 5.6, Chapter 7.1 to 7.4, Chapter 16.1, 16.2, 16.3, 16.5 to 16.9, and Chapter 14.1, 14.2, 14.3).

Reference Books:

1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

ANALOG AND DIGITAL ELECTRONICS LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER - III

Laboratory Code	17CSL37	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Descriptions (if any)

Any simulation package like MultiSim / P-spice /Equivalent software may be used.

Faculty-in-charge should demonstrate and explain the required hardware components and their functional Block diagrams, timing diagrams etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-upon analog components; functional block diagram, Pin diagram (if any), waveforms and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-upon Logic design components, pin diagram (if any), Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are to be evaluated for 40 marks as lab experiments.

Laboratory Experiments:

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.

NOTE: hardware and software results need to be compared

4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.

<p>6. a) Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using basic gates.</p> <p>7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.</p> <p>8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.</p> <p>b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.</p> <p>9. a) Design and implement a mod-n ($n < 8$) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.</p> <p>b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.</p> <p>10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC- 7447).</p> <p>11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).</p> <p>Study experiment</p> <p>12. To study 4-bit ALU using IC-74181.</p>
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<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Demonstrate various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit. • Design and demonstrate various combinational logic circuits. • Design and demonstrate various types of counters and Registers using Flip-flops • Make use of simulation package to design circuits. • Infer the working and implementation of ALU.
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<p>Conduction of Practical Examination:</p> <ol style="list-style-type: none"> 1 . All laboratory experiments (1 to 11 nos) are to be included for practical examination. 2 . Students are allowed to pick one experiment from the lot. 3 . Strictly follow the instructions as printed on the cover page of answer script. 4 . Marks distribution: <ol style="list-style-type: none"> a) For questions having part a only- Procedure + Conduction + Viva: 15 + 70 +15 =100 Marks b) For questions having part a and b <ol style="list-style-type: none"> Part a- Procedure + Conduction + Viva: 09 + 42 +09= 60 Marks Part b- Procedure + Conduction + Viva: 06 + 28 +06= 40 Marks 5 . Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

(Effective from the academic year 2017 -2018)			
SEMESTER - III			
Laboratory Code	17CSL38	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 02			
Descriptions (if any) <p style="text-align: center;">Implement all the experiments in C Language under Linux / Windows environment.</p>			
Laboratory Experiments: <ol style="list-style-type: none"> 1. Design, Develop and Implement a menu driven Program in C for the following Array operations <ol style="list-style-type: none"> a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit. <p>Support the program with functions for each of the above operations.</p> 2. Design, Develop and Implement a Program in C for the following operations on Strings <ol style="list-style-type: none"> a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR <p>Support the program with functions for each of the above operations. Don't use Built-in functions.</p> 3. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) <ol style="list-style-type: none"> a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit <p>Support the program with appropriate functions for each of the above operations</p> 4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands. 5. Design, Develop and Implement a Program in C for the following Stack Applications <ol style="list-style-type: none"> a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks 			

6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
- Insert an Element on to Circular QUEUE
 - Delete an Element from Circular QUEUE
 - Demonstrate *Overflow* and *Underflow* situations on Circular QUEUE
 - Display the status of Circular QUEUE
 - Exit
- Support the program with appropriate functions for each of the above operations

7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: *USN, Name, Branch, Sem, PhNo*
- Create a **SLL** of **N** Students Data by using *front insertion*.
 - Display the status of **SLL** and count the number of nodes in it
 - Perform Insertion / Deletion at End of **SLL**
 - Perform Insertion / Deletion at Front of **SLL**(**Demonstration of stack**)
 - Exit

8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: *SSN, Name, Dept, Designation, Sal, PhNo*
- Create a **DLL** of **N** Employees Data by using *end insertion*.
 - Display the status of **DLL** and count the number of nodes in it
 - Perform Insertion and Deletion at End of **DLL**
 - Perform Insertion and Deletion at Front of **DLL**
 - Demonstrate how this **DLL** can be used as **Double Ended Queue**
 - Exit

9. Design, Develop and Implement a Program in C for the following operations on **Singly Circular Linked List (SCLL)** with header nodes
- Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$
 - Find the sum of two polynomials **POLY1(x,y,z)** and **POLY2(x,y,z)** and store the result in **POLYSUM(x,y,z)**

Support the program with appropriate functions for each of the above operations

10. Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers
- Create a BST of **N** Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
 - Traverse the BST in Inorder, Preorder and Post Order
 - Search the BST for a given element (**KEY**) and report the appropriate message
 - Exit

11. Design, Develop and Implement a Program in C for the following operations on **Graph(G)** of Cities
- Create a Graph of **N** cities using Adjacency Matrix.
 - Print all the nodes **reachable** from a given starting node in a digraph using DFS/BFS method

12. Given a File of **N** employee records with a set **K** of Keys(4-digit) which uniquely determine the records in file **F**. Assume that file **F** is maintained in memory by a Hash Table(HT) of **m** memory locations with **L** as the set of memory addresses (2-digit) of locations in HT. Let the keys in **K** and addresses in **L** are Integers. Design and develop a Program in C that uses Hash function **H: K →L** as $H(K)=K \bmod m$ (remainder method), and implement hashing technique to map a given key **K** to the address space **L**. Resolve the collision (if any) using **linear probing**.

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- Analyze and Compare various linear and non-linear data structures
- Demonstrate the working nature of different types of data structures and their applications
- Develop, analyze and evaluate the searching and sorting algorithms
- Choose the appropriate data structure for solving real world problems

Conduction of Practical Examination:

1. All laboratory experiments (**TWELVE** nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva:**15 + 70 +15 (100)**
5. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

<p style="text-align: center;">ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV</p>			
Subject Code	17MAT41	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor’s series method, modified Euler’s method. Runge - Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae-single step computation only).			10 Hours
Module 2			Teaching Hours
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne’s method. (No derivations of formulae-single step computation only). Special Functions: Series solution of Bessel’s differential equation leading to $J_n(x)$ -Bessel’s function of first kind. Basic properties and orthogonality. Series solution of Legendre’s differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue’s formula, problems			10 Hours
Module 3			Teaching Hours
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem (without proof) and problems. Transformations: Conformal transformations-Discussion of transformations: $w = z^2$, $w = e^z$, $w = z + (1/z)$ ($z \neq 0$), Bilinear transformations-problems.			10 Hours
Module 4			Teaching Hours
Probability Distributions: Random variables (discrete and continuous), probability functions. Poisson distributions, geometric distribution, uniform distribution, exponential and normal distributions, Problems. Joint probability distribution: Joint Probability distribution for two variables, expectation, covariance, correlation coefficient.			10 Hours
Module 5			Teaching Hours
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic process, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.			10 Hours
Course Outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Solve first and second order ordinary differential equation arising in flow problems using single step and multistep numerical methods. • Illustrate problems of potential theory, quantum mechanics and heat conduction by employing notions and properties of Bessel’s functions and Legendre’s polynomials. • Explain the concepts of analytic functions, residues, poles of complex potentials and describe 			

conformal and Bilinear transformation arising in field theory and signal processing.

- Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and design engineering.
- Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
2. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 42nd edition, 2013.

Reference Books:

1. N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, latest edition.
2. Kreyszig, "Advanced Engineering Mathematics " - 9th edition, Wiley, 2013.
3. H. K Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand, 1st ed, 2011.

OBJECT ORIENTED CONCEPTS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS42	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module 1			Teaching Hours
Introduction to Object Oriented Concepts: A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. Class and Objects: Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors. Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2			08 Hours
Module 2			Teaching Hours
Introduction to Java: Java’s magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5			08 Hours
Module 3			Teaching Hours
Classes, Inheritance, Exceptions, Packages and Interfaces: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. Inheritance: inheritance basics, using super, creating multi level hierarchy, method overriding. Exception handling: Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces. Text book 2: Ch:6 Ch: 8 Ch:9 Ch:10			08 Hours
Module 4			Teaching Hours
Multi Threaded Programming, Event Handling: Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Text book 2: Ch 11: Ch: 22			08 Hours
Module 5			Teaching Hours
The Applet Class: Introduction, Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface;Output to the Console. Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable. Text book 2: Ch 21: Ch: 29 Ch: 30			08 Hours

<p>Course Outcomes: After studying this course, students will be able to</p> <ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users, and to comprehend the event-based GUI handling principles using Applets and swings.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) 2. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30)
<p>Reference Book:</p> <ol style="list-style-type: none"> 1. Mahesh Bhavde and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 2. Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. 3. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. 4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 5. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. 6. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
<p>Note: Every institute shall organize a bridge organize on C++ either in the vacation or in the beginning of even semester.</p>

DESIGN AND ANALYSIS OF ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS43	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			Teaching Hours
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			Teaching Hours
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			Teaching Hours
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			Teaching Hours
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> Describe computational solution to well known problems like searching, sorting etc. Estimate the computational complexity of different algorithms. 			

- Develop an algorithm using appropriate design strategies for problem solving.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin., 2nd Edition, 2009. Pearson.

T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI

2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)

MICROPROCESSORS AND MICROCONTROLLERS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS44	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
The x86 microprocessor: Brief history of the x86 family, Inside the 8088/86, Introduction to assembly programming, Introduction to Program Segments, The Stack, Flag register, x86 Addressing Modes. Assembly language programming: Directives & a Sample Program, Assemble, Link & Run a program, More Sample programs, Control Transfer Instructions, Data Types and Data Definition, Full Segment Definition, Flowcharts and Pseudo code. Text book 1: Ch 1: 1.1 to 1.7, Ch 2: 2.1 to 2.7			10 Hours
Module 2			
x86: Instructions sets description, Arithmetic and logic instructions and programs: Unsigned Addition and Subtraction, Unsigned Multiplication and Division, Logic Instructions, BCD and ASCII conversion, Rotate Instructions. INT 21H and INT 10H Programming : Bios INT 10H Programming , DOS Interrupt 21H. 8088/86 Interrupts, x86 PC and Interrupt Assignment. Text book 1: Ch 3: 3.1 to 3.5, Ch 4: 4.1 , 4.2 Chapter 14: 14.1 and 14.2			10 Hours
Module 3			
Signed Numbers and Strings: Signed number Arithmetic Operations, String operations. Memory and Memory interfacing: Memory address decoding, data integrity in RAM and ROM, 16-bit memory interfacing. 8255 I/O programming: I/O addresses MAP of x86 PC's, programming and interfacing the 8255. Text book 1: Ch 6: 6.1, 6.2. Ch 10: 10.2, 10.4, 10.5. Ch 11: 11.1 to 11.4			10 Hours
Module 4			
Microprocessors versus Microcontrollers, ARM Embedded Systems : The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals : Registers , Current Program Status Register , Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions Text book 2:Ch 1:1.1 to 1.4, Ch 2:2.1 to 2.5			10 Hours
Module 5			
Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises. Text book 2: Ch 3:3.1 to 3.6 (Excluding 3.5.2)			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Differentiate between microprocessors and microcontrollers • Develop assembly language code to solve problems • Explain interfacing of various devices to x86 family and ARM processor • Demonstrate interrupt routines for interfacing devices 			
Question paper pattern:			

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Danny Causey, The x86 PC Assembly Language Design and Interfacing, 5th Edition, Pearson, 2013.
2. **ARM system developers guide**, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

Reference Books:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala : The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition , Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

SOFTWARE ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS45	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module 1			Teaching Hours
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model (Sec 2.1.1), Incremental Model (Sec 2.1.2) and Spiral Model (Sec 2.1.3). Process activities. Requirements Engineering: Requirements Engineering Processes (Chap 4). Requirements Elicitation and Analysis (Sec 4.5). Functional and non-functional requirements (Sec 4.1). The software Requirements Document (Sec 4.2). Requirements Specification (Sec 4.3). Requirements validation (Sec 4.6). Requirements Management (Sec 4.7).			12 Hours
Module 2			Teaching Hours
System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 17). Object-oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open source development (Sec 7.4).			11 Hours
Module 3			Teaching Hours
Software Testing: Development testing (Sec 8.1), Test-driven development (Sec 8.2), Release testing (Sec 8.3), User testing (Sec 8.4). Test Automation (Page no 42, 70,212, 231,444,695). Software Evolution: Evolution processes (Sec 9.1). Program evolution dynamics (Sec 9.2). Software maintenance (Sec 9.3). Legacy system management (Sec 9.4).			9 Hours
Module 4			Teaching Hours
Project Planning: Software pricing (Sec 23.1). Plan-driven development (Sec 23.2). Project scheduling (Sec 23.3): Estimation techniques (Sec 23.5). Quality management: Software quality (Sec 24.1). Reviews and inspections (Sec 24.3). Software measurement and metrics (Sec 24.4). Software standards (Sec 24.2)			10 Hours
Module 5			Teaching Hours
Agile Software Development: Coping with Change (Sec 2.3), The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref “The SCRUM Primer, Ver 2.0”) and Extreme Programming (Sec 3.3). Plan-driven and agile development (Sec 3.2). Agile project management (Sec 3.4), Scaling agile methods (Sec 3.5):			8 Hours
Course Outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Design a software system, component, or process to meet desired needs within realistic constraints. • Assess professional and ethical responsibility • Function on multi-disciplinary teams • Make use of techniques, skills, and modern engineering tools necessary for engineering 			

practice

- Comprehend software systems or parts of software systems.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
(Listed topics only from Chapters 1,2,3,4, 5, 7, 8, 9, 23, and 24)
2. The SCRUM Primer, Ver 2.0, <http://www.goodagile.com/scrumpriemer/scrumpriemer20.pdf>

Reference Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

Web Reference for eBooks on Agile:

1. <http://agilemanifesto.org/>
2. <http://www.jamesshore.com/Agile-Book/>

DATA COMMUNICATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – IV			
Subject Code	17CS46	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Contents			Teaching Hours
Module 1			
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).			10 Hours
Module 2			
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion, Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching.			10 Hours
Module 3			
Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only).			10 Hours
Module 4			
Media Access control: Random Access, Controlled Access and Channelization, Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth.			10 Hours
Module 5			
Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols : Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Illustrate basic computer network technology. • Identify the different types of network topologies and protocols. • List and explain the layers of the OSI model and TCP/IP model. • Comprehend the different types of network devices and their functions within a network • Demonstrate subnetting and routing mechanisms. 			
Question paper pattern:			
<p>The question paper will have ten questions.</p> <p>There will be 2 questions from each module.</p> <p>Each question will have questions covering all the topics under a module.</p> <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			

Text Book:

Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013. (Chapters 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6, 4.1 to 4.3, 5.1, 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.5, 11.1 to 11.4, 12.1 to 12.3, 13.1 to 13.5, 15.1 to 15.3, 16.1 to 16.3, 19.1 to 19.3, 22.1 to 22.4)

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2017 -2018)

SEMESTER – IV

Subject Code	17CSL47	IA Marks	40
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02**Description**

Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment. Netbeans/Eclipse IDE tool can be used for development and demonstration.

Experiments

1	A	Create a Java class called <i>Student</i> with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>nStudent</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.
2	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.
3	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.
	B	Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.
4		Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000 and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
5		Sort a given set of <i>n</i> integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000, and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-

	and-conquer method works along with its time complexity analysis: worst case, average case and best case.
6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Outcomes: The students should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Develop variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

Conduction of Practical Examination:

All laboratory experiments (Twelve problems) are to be included for practical examination. Students are allowed to pick one experiment from the lot.

To generate the data set use random number generator function.

Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Marks distribution: Procedure + Conduction + Viva: 15 + 70 + 15 (100). Change of experiment is allowed only once and marks allotted to the procedure

MICROPROCESSOR AND MICROCONTROLLER LABORATORY**[As per Choice Based Credit System (CBCS) scheme]****(Effective from the academic year 2017 -2018)****SEMESTER – IV**

Subject Code	17CSL48	IA Marks	40
Number of Lecture Hours/Week	01 I + 02 P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02**Description**

Demonstration and Explanation hardware components and Faculty in-charge should explain 8086 architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Laboratory Session-1: Write-up on Microprocessors, 8086 Functional block diagram, Pin diagram and description. The same information is also taught in theory class; this helps the students to understand better.

Laboratory Session-2: Write-up on Instruction group, Timing diagrams, etc. The same information is also taught in theory class; this helps the students to understand better.

Note: These TWO Laboratory sessions are used to fill the gap between theory classes and practical sessions. Both sessions are evaluated as lab experiments for 20 marks.

Experiments

- Develop and execute the following programs using 8086 Assembly Language. Any suitable assembler like MASM/TASM/8086 kit or any equivalent software may be used.
- Program should have suitable comments.
- The board layout and the circuit diagram of the interface are to be provided to the student during the examination.
- Software Required: Open source ARM Development platform, KEIL IDE and Proteus for simulation

SOFTWARE PROGRAMS: PART A

1. Design and develop an assembly language program to search a key element "X" in a list of 'n' 16-bit numbers. Adopt Binary search algorithm in your program for searching.
2. Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.
3. Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Develop an assembly language program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.
5. Design and develop an assembly language program to read the current time and Date from the system and display it in the standard format on the screen.
6. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).
7. To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)

Note : To use KEIL one may refer the book: Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

HARDWARE PROGRAMS: PART B

8. a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface.
b. Design and develop an assembly program to read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display $X*Y$.
9. Design and develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor is it necessary for the student to compute these values).
10. Design and develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
11. Design and develop an assembly language program to
 - a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO).
 - b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO).
12. To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD
13. To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor

Study Experiments:

1. Interfacing of temperature sensor with ARM freedom board (or any other ARM microprocessor board) and display temperature on LCD
2. To design ARM cortex based automatic number plate recognition system
3. To design ARM based power saving system

Course Outcomes: After studying this course, students will be able to

- Summarize 80x86 instruction sets and comprehend the knowledge of how assembly language works.
- Design and develop assembly programs using 80x86 assembly language instructions
- Infer functioning of hardware devices and interfacing them to x86 family
- Choose processors for various kinds of applications.

Conduction of Practical Examination:

- All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.
- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva: **08 + 35 +07 (50)**
- PART –B: Procedure + Conduction + Viva: **08 + 35 +07 (50)**
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS51	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection			10 Hours
Module – 2			
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination- meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.			10 Hours
Module – 3			
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.			10 Hours
Module – 4			
Preparation of project and ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report, Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation			10 Hours
Module – 5			
Micro and Small Enterprises: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises, case study (Microsoft), Case study(Captain G R Gopinath),case study (N R Narayana Murthy & Infosys), Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Define management, organization, entrepreneur, planning, staffing, ERP and outline their importance in entrepreneurship • Utilize the resources available effectively through ERP • Make use of IPRs and institutional support in entrepreneurship 			
Question paper pattern:			

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship - Kanishka Bedi- Oxford University Press-2017

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier – Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS52	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables. T1: Chap 2			10 Hours
Module – 2			
Transport Layer : Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control. T1: Chap 3			10 Hours
Module – 3			
The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7			10 Hours
Module – 4			
Wireless and Mobile Networks: Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G:LTE,Mobility management: Principles,			10 Hours

Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols. T1: Chap: 6 : 6.4-6.8	
Module – 5	
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case study: You Tube. Network Support for Multimedia: Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission T1: Chap: 7	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain principles of application layer protocols • Outline transport layer services and infer UDP and TCP protocols • Classify routers, IP and Routing Algorithms in network layer • Explain the Wireless and Mobile Networks covering IEEE 802.11 Standard • Define Multimedia Networking and Network Management 	
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .	
Reference Books:	
1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition 2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning	

DATABASE MANAGEMENT SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS53	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization. Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10			10 Hours
Module – 2			Teaching Hours
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5			10 Hours
Module – 3			Teaching Hours
SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7.			10 Hours
Module – 4			Teaching Hours
Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms			10 Hours

Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6	
Module – 5	
<p>Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures</p> <p>Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7.</p>	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Summarize the concepts of database objects; enforce integrity constraints on a database using RDBMS. • Use Structured Query Language (SQL) for database manipulation. • Design simple database systems • Design code for some application to interact with databases. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson. 2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill 	
Reference Books:	
<ol style="list-style-type: none"> 1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2013. 2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. 	

AUTOMATA THEORY AND COMPUTABILITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS54	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, From FSMs to Operational Systems, Simulators for FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers. Textbook 1: Ch 1,2, 3,4, 5.1 to 5.10			10 Hours
Module – 2			
Regular Expressions (RE): what is a RE?, Kleene’s theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non-regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs. Textbook 1: Ch 6, 7, 8: 6.1 to 6.4, 7.1, 7.2, 8.1 to 8.4			10 Hours
Module – 3			
Context-Free Grammars(CFG): Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms. Pushdown Automata (PDA): Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non-determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA. Textbook 1: Ch 11, 12: 11.1 to 11.8, 12.1, 12.2, 12.4, 12.5, 12.6			10 Hours
Module – 4			
Context-Free and Non-Context-Free Languages: Where do the Context-Free Languages(CFL) fit, Showing a language is context-free, Pumping theorem for CFL, Important closure properties of CFLs, Deterministic CFLs. Algorithms and Decision Procedures for CFLs: Decidable questions, Un-decidable questions. Turing Machine: Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Textbook 1: Ch 13: 13.1 to 13.5, Ch 14: 14.1, 14.2, Textbook 2: Ch 9.1 to 9.6			10 Hours
Module – 5			
Variants of Turing Machines (TM), The model of Linear Bounded automata: Decidability: Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. Complexity: Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Textbook 2: Ch 9.7 to 9.8, 10.1 to 10.7, 12.1, 12.2, 12.8, 12.8.1, 12.8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Tell the core concepts in automata theory and Theory of Computation 			

- Explain how to translate between different models of Computation (e.g., Deterministic and Non-deterministic and Software models).
- Interpret Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.
- Develop skills in formal reasoning and reduction of a problem to a formal model, with an emphasis on semantic precision and conciseness.
- Classify a problem with respect to different models of Computation.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013
2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PHI, 2012.

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013
2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013
3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013
4. Peter Linz, “An Introduction to Formal Languages and Automata”, 3rd Edition, Narosa Publishers, 1998
5. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012
6. C K Nagpal, Formal Languages and Automata Theory, Oxford University press, 2012.

OBJECT ORIENTED MODELING AND DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS551	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modelling, Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. Text Book-1: Ch 1, 2, 3 and 4			8 Hours
Module – 2			Teaching Hours
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models. Text Book-2:Chapter- 6:Page 210 to 250			8 Hours
Module – 3			Teaching Hours
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis. Text Book-1:Chapter- 10,11,and 12			8 Hours
Module – 4			Teaching Hours
Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design. Text Book-2: Chapter 8: page 292 to 346			8 Hours
Module – 5			Teaching Hours
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only). Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4.			8 Hours
Course outcomes: The students should be able to:			

- Describe the concepts of object-oriented and basic class modelling.
- Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
- Choose and apply a befitting design pattern for the given problem.

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education, 2007.

Reference Books:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons. 2007.
3. Booch, Jacobson, Rumbaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, Pearson, Reprint 2013

INTRODUCTION TO SOFTWARE TESTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS552	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. Textbook 3: Ch 1:1.2 - 1.5, 3; Textbook 1: Ch 1			8 Hours
Module – 2			Teaching Hours
Problem Statements: Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, NextDate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Textbook 1: Ch 2, 5, 6 & 7, Textbook 2: Ch 3			8 Hours
Module – 3			Teaching Hours
Fault Based Testing: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. Structural Testing: Overview, Statement testing, Branch testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. T2:Chapter 16, 12 T1:Chapter 9 & 10			8 Hours
Module – 4			Teaching Hours
Test Execution: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. Planning and Monitoring the Process: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team. T2: Chapter 17, 20.			8 Hours
Module – 5			Teaching Hours
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and			8 Hours

<p>Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing, Integration Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.</p> <p>T2: Chapter 21 & 22, T1 : Chapter 12 & 13</p>	
<p>Course outcomes: The students should be able to:</p>	
<ul style="list-style-type: none"> • Identify test cases for any given problem. • Compare the different testing techniques. • Classify the problems according to a suitable testing model. • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
<p>Text Books:</p>	
<ol style="list-style-type: none"> 1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. 	
<p>Reference Books:</p>	
<ol style="list-style-type: none"> 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004. 3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015 5. Naresh Chauhan, Software Testing, Oxford University press. 	

ADVANCED JAVA AND J2EE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CS553	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.			8 Hours
Module – 2			
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.			8 Hours
Module – 3			
String Handling : The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString() Character Extraction, charAt(), getChars(), getBytes() toCharArray(), String Comparison, equals() and equalsIgnoreCase(), regionMatches() startsWith() and endsWith(), equals() Versus == , compareTo() Searching Strings, Modifying a String, substring(), concat(), replace(), trim(), Data Conversion Using valueOf(), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length() and capacity(), ensureCapacity(), setLength(), charAt() and setCharAt(), getChars(),append(), insert(), reverse(), delete() and deleteCharAt(), replace(), substring(), Additional StringBuffer Methods, StringBuilder			8 Hours
Text Book 1: Ch 15			
Module – 4			
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects			8 Hours

Text Book 1: Ch 31 Text Book 2: Ch 11	
Module – 5	
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. Text Book 2: Ch 06	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs • Build client-server applications and TCP/IP socket programs • Illustrate database access and details for managing information using the JDBC API • Describe how servlets fit into Java-based web application architecture • Develop reusable software components using Java Beans 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007. 2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007. 2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004. 3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015. 	

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017-2018) SEMESTER – V			
Subject Code	17CS554	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Analysis Techniques: Growth functions, Recurrences and solution of recurrence equations; Amortized analysis: Aggregate, Accounting, and Potential methods, String Matching Algorithms: Naive Algorithm; Robin-Karp Algorithm, String matching with Finite Automata, Knuth-Morris-Pratt and Boyer-Moore Algorithms			8 Hours
Module – 2			
Number Theoretic Algorithms: Elementary notions, GCD, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element RSA Cryptosystem, Primality testing, Integer factorization, - Huffman Codes, Polynomials. FFT-Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials			8 Hours
Module – 3			
DFT and FFT efficient implementation of FFT, Graph Algorithms, Bellman-Ford Algorithm Shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Flow networks and the Ford-Fulkerson Algorithm, Maximum bipartite matching.			8 Hours
Module – 4			
Computational Geometry-I: Geometric data structures using, C, Vectors, Points, Polygons, Edges Geometric objects in space; Finding the intersection of a line and a triangle, Finding star-shaped polygons using incremental insertion.			8 Hours
Module – 5			
Computational Geometry-II: Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; Convex hulls, Gift wrapping and Graham Scan; Removing hidden surfaces			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the principles of algorithms analysis approaches • Apply different theoretic based strategies to solve problems • Illustrate the complex signals and data flow in networks with usage of tools • Describe the computational geometry criteria. 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Thomas H. Cormen et al: Introduction to Algorithms, Prentice Hall India, 1990 2. Michael J. Laszlo: Computational Geometry and Computer Graphics in C' Prentice Hall India, 1996 			

Reference Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, Fundamentals of Computer Algorithms, University Press, Second edition, 2007
2. Kenneth A Berman & Jerome L Paul, Algorithms, Cengage Learning, First Indian reprint, 2008

PROGRAMMING IN JAVA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS561	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings Text book 1: Ch 2, Ch 3			8 Hours
Module – 2			Teaching Hours
Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java’s Selection Statements, Iteration Statements, Jump Statements. Text book 1: Ch 4, Ch 5			8 Hours
Module – 3			Teaching Hours
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. Text book 1: Ch 6, Ch 7.1-7.9, Ch 8.			8 Hours
Module – 4			Teaching Hours
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java’s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. Text book 1: Ch 9, Ch 10			8 Hours
Module – 5			Teaching Hours
Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this(), String Handling: The String			8 Hours

Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.	
Text book 1: Ch 12.1,12.2, Ch 13, Ch 15	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the object-oriented concepts and JAVA. • Develop computer programs to solve real world problems in Java. • Develop simple GUI interfaces for a computer program to interact with users 	
Question paper pattern:	
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.	
Text Books:	
1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)	
Reference Books:	
<ol style="list-style-type: none"> 1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806. 2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. 3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017. 	

ARTIFICIAL INTELLIGENCE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS562	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
What is artificial intelligence?, Problems, Problem Spaces and search, Heuristic search technique TextBook1: Ch 1, 2 and 3			8 Hours
Module – 2			
Knowledge Representation Issues, Using Predicate Logic, Representing knowledge using Rules, TextBook1: Ch 4, 5 and 6.			8 Hours
Module – 3			
Symbolic Reasoning under Uncertainty, Statistical reasoning, Weak Slot and Filter Structures. TextBook1: Ch 7, 8 and 9.			8 Hours
Module – 4			
Strong slot-and-filler structures, Game Playing. TextBook1: Ch 10 and 12			8 Hours
Module – 5			
Natural Language Processing, Learning, Expert Systems. TextBook1: Ch 15,17 and 20			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Identify the AI based problems • Apply techniques to solve the AI problems • Define learning and explain various learning techniques • Discuss expert systems 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. E. Rich , K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.			
Reference Books:			
1. Artificial Intelligence: A Modern Approach, Stuart Rusell, Peter Norving, Pearson Education 2nd Edition.			
1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems – Prentice Hal of India.			
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem			

Solving”, Fourth Edition, Pearson Education, 2002.

3. Artificial Intelligence and Expert Systems Development by D W Rolston-Mc Graw hill.
4. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford University Press-2015

EMBEDDED SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS563	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.			8 Hours
Module – 2			
Devices and communication buses for devices network: IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.			8 Hours
Module – 3			
Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.			8 Hours
Module – 4			
Inter process communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.			8 Hours
Module – 5			
Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded software development process and tools, Host and target machines, Linking and location software.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> Distinguish the characteristics of embedded computer systems. 			

- Identify the various vulnerabilities of embedded computer systems.
- Design and develop modules using RTOS.
- Explain RPC, threads and tasks

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Raj Kamal, "Embedded Systems: Architecture, Programming, and Design" 2nd / 3rd edition, Tata McGraw hill-2013.

Reference Books:

1. Marilyn Wolf, "Computer as Components, Principles of Embedded Computing System Design" 3rd edition, Elsevier-2014.

DOT NET FRAMEWORK FOR APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS564	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions T1: Chapter 1 – Chapter 6			8 Hours
Module – 2			
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays Textbook 1: Ch 7 to 10			8 Hours
Module – 3			
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management Textbook 1: Ch 11 to 14			8 Hours
Module – 4			
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections Textbook 1: Ch 15 to 18			8 Hours
Module – 5			
Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading Textbook 1: Ch 19 to 22			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C# • Demonstrate Object Oriented Programming concepts in C# programming language • Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications. • Illustrate the use of generics and collections in C# • Compose queries to query in-memory data and define own operator behaviour 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. John Sharp, Microsoft Visual C# Step by Step, 8 th Edition, PHI Learning Pvt. Ltd. 2016			

Reference Books:

1. Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016.
Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O'Reilly Publications, 2013.
2. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
3. Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – V			
Subject Code	17CS565	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology			8 Hours
Module – 2			8 Hours
Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools			8 Hours
Module – 3			8 Hours
Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming			8 Hours

Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, , Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the concepts and terminologies of cloud computing • Demonstrate cloud frameworks and technologies • Define data intensive computing • Demonstrate cloud applications 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
NIL	

COMPUTER NETWORK LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CSL57	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

For the experiments below modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Lab Experiments:

PART A

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
4. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
5. Implement and study the performance of GSM on NS2/NS3 (Using MAC layer) or equivalent environment.
6. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment.

PART B

Implement the following in Java:

7. Write a program for error detecting code using CRC-CCITT (16- bits).
8. Write a program to find the shortest path between vertices using bellman-ford algorithm.
9. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program on datagram socket for client/server to display the messages on client side, typed at the server side.
11. Write a program for simple RSA algorithm to encrypt and decrypt the data.
12. Write a program for congestion control using leaky bucket algorithm.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Analyze and Compare various networking protocols.
- Demonstrate the working of different concepts of networking.
- Implement and analyze networking protocols in NS2 / NS3

Conduction of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from part A and part B with lot.
3. Strictly follow the instructions as printed on the cover page of answer script

4. Marks distribution: Procedure + Conduction + Viva: 100

Part A: 8+35+7 =50

Part B: 8+35+7 =50

5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017-2018)
SEMESTER – V

Subject Code	17CSL58	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

Part A: SQL Programming

1	<p>Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id, Branch_id, No-of_Copies) BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH(Branch_id, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
2	<p>Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day.

	<p>5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.</p>
3	<p>Consider the schema for Movie Database: ACTOR(<u>Act_id</u>, Act_Name, Act_Gender) DIRECTOR(<u>Dir_id</u>, Dir_Name, Dir_Phone) MOVIES(<u>Mov_id</u>, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(<u>Act_id</u>, <u>Mov_id</u>, Role) RATING(<u>Mov_id</u>, Rev_Stars) Write SQL queries to</p> <ol style="list-style-type: none"> 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5.
4	<p>Consider the schema for College Database: STUDENT(<u>USN</u>, SName, Address, Phone, Gender) SEMSEC(<u>SSID</u>, Sem, Sec) CLASS(<u>USN</u>, <u>SSID</u>) SUBJECT(<u>Subcode</u>, Title, Sem, Credits) IAMARKS(<u>USN</u>, <u>Subcode</u>, <u>SSID</u>, Test1, Test2, Test3, FinalIA) Write SQL queries to</p> <ol style="list-style-type: none"> 1. List all the student details studying in fourth semester 'C' section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI17CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.
5	<p>Consider the schema for Company Database: EMPLOYEE(<u>SSN</u>, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(<u>DNo</u>, DName, MgrSSN, MgrStartDate) DLOCATION(<u>DNo</u>, <u>DLoc</u>) PROJECT(<u>PNo</u>, PName, PLocation, DNo) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours) Write SQL queries to</p> <ol style="list-style-type: none"> 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department

	<ol style="list-style-type: none"> 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
Part B: Mini project	
<ul style="list-style-type: none"> • For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process. • Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. • Indicative areas include; health care, education, industry, transport, supply chain, etc. 	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Use Structured Query Language (SQL) for database Creation and manipulation. • Demonstrate the working of different concepts of DBMS • Implement and test the project developed for an application. 	
Conduction of Practical Examination: <ol style="list-style-type: none"> 1. All laboratory experiments from part A are to be included for practical examination. 2. Mini project has to be evaluated for 40 Marks. 3. Report should be prepared in a standard format prescribed for project work. 4. Students are allowed to pick one experiment from the lot. 5. Strictly follow the instructions as printed on the cover page of answer script. 6. Marks distribution: <ol style="list-style-type: none"> a) Part A: Procedure + Conduction + Viva: 09 + 42 + 09 = 60 Marks 7. Part B: Demonstration + Report + Viva voce = 20+14+06 = 40 Marks 8. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. 	

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS61	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.			10 Hours
Module – 2			
Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications.			10 Hours
Module – 3			
Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity-based Encryption, Authentication-I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPsec-Security at the Network Layer – Security at Different layers: Pros and Cons, IPsec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL.			10 Hours
Module – 4			
IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Intrusion Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS- Security, SAML, Other Standards.			10 Hours
Module – 5			
IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Discuss the cryptography and its need to various applications • Design and Develop simple cryptography algorithms 			

- Understand the cyber security and need cyber Law

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25

Reference Books:

1. Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyay, Mc-GrawHill, 3rd Edition, 2015
2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition
3. Cyber Law simplified- VivekSood, Mc-GrawHill, 11th reprint , 2013
4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindrakumar, Cengage learning

COMPUTER GRAPHICS AND VISUALIZATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS62	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Overview: Computer Graphics and OpenGL: Computer Graphics:Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, graphics workstations and viewing systems, Input devices, graphics networks, graphics on the internet, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham’s), circle generation algorithms(Bresenham’s). Text-1:Chapter -1: 1-1 to 1-9,2-1 to 2-9 (Excluding 2-5),3-1 to 3-5,3-9,3-20			10 Hours
Module – 2			
Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Text-1:Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4			10 Hours
Module – 3			
Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions. Text-1:Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12-4,12-6,10-1,10-3			10 Hours
Module – 4			
3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from			10 Hours

<p>world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, back face detection, depth buffer method and OpenGL visibility detection functions.</p> <p>Text-1:Chapter: 7-1 to 7-10(Excluding 7-7), 9-1 to 9-3, 9-14</p>	
Module – 5	
<p>Input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.</p> <p>Text-1:Chapter :8-3 to 8-6 (Excluding 8-5),8-9,8-10,8-11,3-8,8-18,13-11,3-2,13-3,13-4,13-10</p> <p>Text-2:Chapter 3: 3-1 to 3.11: Input& interaction</p>	10 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Design and implement algorithms for 2D graphics primitives and attributes. • Illustrate Geometric transformations on both 2D and 3D objects. • Understand the concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models. • Discuss about suitable hardware and software for developing graphics packages using OpenGL. 	
<p>Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4thEdition, Pearson Education,2011 2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008 	
Reference Books:	
<ol style="list-style-type: none"> 1. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education 2. Xiang, Plastock : Computer Graphics , sham’s outline series, 2nd edition, TMG. 3. Kelvin Sung, Peter Shirley, steven Baer : Interactive Computer Graphics, concepts and applications, Cengage Learning 4. M MRaiker, Computer Graphics using OpenGL, Filip learning/Elsevier 	

SYSTEM SOFTWARE AND COMPILER DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS63	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Macroprocessors: Basic macro processor functions, Text book 1: Chapter 1: 1.1,1.2,1.3.1,1.3.2, Chapter2 : 2.1-2.4,Chapter4: 4.1.1,4.1.2			10 Hours
Module – 2			
Loaders and Linkers: Basic Loader Functions, Machine Dependent Loader Features, Machine Independent Loader Features, Loader Design Options, Implementation Examples. Text book 1 : Chapter 3 ,3.1 -3.5			10 Hours
Module – 3			
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building compiler, Applications of compiler technology, Programming language basics Lexical Analysis: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens, lexical analyzer generator, Finite automate. Text book 2:Chapter 1 1.1-1.6 Chapter 3 3.1 – 3.6			10 Hours
Module – 4			
Syntax Analysis: Introduction, Role Of Parsers, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers, Operator-Precedence Parsing Text book 2: Chapter 4 4.1 4.2 4.3 4.4 4.5 4.6 Text book 1 : 5.1.3			10 Hours
Module – 5			
Syntax Directed Translation, Intermediate code generation, Code generation Text book 2: Chapter 5.1, 5.2, 5.3, 6.1, 6.2, 8.1, 8.2			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Illustrate system software such as assemblers, loaders, linkers and macroprocessors • Design and develop lexical analyzers, parsers and code generators • Discuss about lex and yacc tools for implementing different concepts of system software 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. System Software by Leland. L. Beck, D Manjula, 3 rd edition, 2012			

2. Compilers-Principles, Techniques and Tools by Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman. Pearson, 2nd edition, 2007

Reference Books:

1. Systems programming – Srimanta Pal , Oxford university press, 2016
2. System programming and Compiler Design, K C Loudon, Cengage Learning
3. System software and operating system by D. M. Dhamdhare TMG
4. Compiler Design, K Muneeswaran, Oxford University Press 2013.

OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS64	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication			10 Hours
Module – 2			Teaching Hours
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.			10 Hours
Module – 3			Teaching Hours
Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.			10 Hours
Module – 4			Teaching Hours
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.			10 Hours
Module – 5			Teaching Hours
Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output;			10 Hours

Inter-process communication.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Demonstrate need for OS and different types of OS • Discuss suitable techniques for management of different resources • Illustrate processor, memory, storage and file system commands • Explain the different concepts of OS in platform of usage through case studies 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006. 	
Reference Books	
<ol style="list-style-type: none"> 1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition 2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013. 3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson. 	

DATA MINING AND DATA WAREHOUSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS651	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Data Warehousing&modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse,Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.			8 Hours
Module – 2			
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.: Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,			8 Hours
Module – 3			
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.			8 Hours
Module – 4			
Classification : Decision Trees Induction,Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers,Bayesian Classifiers.			8 Hours
Module – 5			
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understands data mining problems and implement the data warehouse • Demonstrate the association rules for a given data pattern. • Discuss between classification and clustering solution. 			
Question paper pattern:			
The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining,			

Pearson, First impression,2014.

2. Jiawei Han, MichelineKamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition,Morgan Kaufmann Publisher, 2012.

Reference Books:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS652	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: what is a design pattern? describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm			8 Hours
Module – 2			
Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.			8 Hours
Module – 3			
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.			8 Hours
Module – 4			
Interactive systems and the MVC architecture: Introduction , The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation , implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.			8 Hours
Module – 5			
Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and implement codes with higher performance and lower complexity • Demonstrate code qualities needed to keep code flexible • Illustrate design principles and be able to assess the quality of a design with respect to these principles. • Explain principles in the design of object oriented systems. • Understand a range of design patterns. • Discuss suitable patterns in specific contexts 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			

1. Object-oriented analysis, design and implementation, brahma dathan, sarnathrammath, universities press,2013
2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, RegineMeunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

OPERATIONS RESEARCH [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS653	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction, Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.			8 Hours
Module – 2			
Simplex Method – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.			8 Hours
Module – 3			
Simplex Method – 2: Duality Theory - The essence of duality theory, Primal-dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method.			8 Hours
Module – 4			
Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.			8 Hours
Module – 5			
Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain optimization techniques for various problems. • Understand the given problem as transportation and assignment problem and solve. • Illustrate game theory for decision support system. 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			

Text Books:

1. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014

Reference Books:

1. S Kalavathy, Operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002
2. S D Sharma, Operation Research, KedarNath Ram Nath Publishers.

DISTRIBUTED COMPUTING SYSTEM [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CS654	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Characterization of Distributed Systems: Introduction, Examples of DS, Resource sharing and the Web, Challenges System Models: Architectural Models, Fundamental Models			8 Hours
Module – 2			
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication Distributed Objects and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications			8 Hours
Module – 3			
Operating System Support: Introduction, The OS layer, Protection, Processes and Threads, Communication and Invocation , Operating system architecture Distributed File Systems: Introduction, File Service architecture, Sun Network File System			8 Hours
Module – 4			
Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections			8 Hours
Module – 5			
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, distributed deadlocks			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the characteristics of a distributed system along with its and design challenges • Illustrate the mechanism of IPC between distributed objects • Describe the distributed file service architecture and the important characteristics of SUN NFS. • Discuss concurrency control algorithms applied in distributed transactions 			
Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. George Coulouris, Jean Dollimore and Tim Kindberg: Distributed Systems – Concepts and Design, 5 th Edition, Pearson Publications, 2009			

Reference Books:

1. Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007
2. Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008
3. SunitaMahajan, Seema Shan, “ Distributed Computing”, Oxford University Press,2015

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS661	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Get started, Build your first app, Activities, Testing, debugging and using support libraries			8 Hours
Module – 2			
User Interaction, Delightful user experience, Testing your UI			8 Hours
Module – 3			
Background Tasks, Triggering, scheduling and optimizing background tasks			8 Hours
Module – 4			
All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders			8 Hours
Module – 5			
Permissions, Performance and Security, Firebase and AdMob, Publish			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Design and Develop Android application by setting up Android development environment • Implement adaptive, responsive user interfaces that work across a wide range of devices. • Explain long running tasks and background work in Android applications • Demonstrate methods in storing, sharing and retrieving data in Android applications • Discuss the performance of android applications and understand the role of permissions and security • Describe the steps involved in publishing Android application to share with the world 			
Question paper pattern:			
The question paper will have TEN questions.			
There will be TWO questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer FIVE full questions, selecting ONE full question from each module.			
Text Books:			
1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details (Download pdf file from the above link)			
Reference Books:			
1. Erik Hellman, "Android Programming – Pushing the Limits", 1 st Edition, Wiley India Pvt Ltd, 2014. 2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1 st Edition, O'Reilly SPD Publishers, 2015. 3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4 th Edition,			

Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580

4. AnubhavPradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS662	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
<p>Introduction to Data Analytics and Decision Making: Introduction, Overview of the Book, The Methods, The Software, Modeling and Models, Graphical Models, Algebraic Models, Spreadsheet Models, Seven-Step Modeling Process. Describing the Distribution of a Single Variable: Introduction, Basic Concepts, Populations and Samples, Data Sets, Variables, and Observations, Types of Data, Descriptive Measures for Categorical Variables, Descriptive Measures for Numerical Variables, Numerical Summary Measures, Numerical Summary Measures with StatTools, Charts for Numerical Variables, Time Series Data, Outliers and Missing Values, Outliers, Missing Values, Excel Tables for Filtering, Sorting, and Summarizing.</p> <p>Finding Relationships among Variables: Introduction, Relationships among Categorical Variables, Relationships among Categorical Variables and a Numerical Variable, Stacked and Unstacked Formats, Relationships among Numerical Variables, Scatterplots, Correlation and Covariance, Pivot Tables.</p>			08 Hours
Module – 2			Teaching Hours
<p>Probability and Probability Distributions: Introduction, Probability Essentials, Rule of Complements, Addition Rule, Conditional Probability and the Multiplication Rule, Probabilistic Independence, Equally Likely Events, Subjective Versus Objective Probabilities, Probability Distribution of a Single Random Variable, Summary Measures of a Probability Distribution, Conditional Mean and Variance, Introduction to Simulation.</p> <p>Normal, Binormal, Poisson, and Exponential Distributions: Introduction, The Normal Distribution, Continuous Distributions and Density Functions, The Normal Density, Standardizing: Z-Values, Normal Tables and Z-Values, Normal Calculations in Excel, Empirical Rules Revisited, Weighted Sums of Normal Random Variables, Applications of the Normal Random Distribution, The Binomial Distribution, Mean and Standard Deviation of the Binomial Distribution, The Binomial Distribution in the Context of Sampling, The Normal Approximation to the Binomial, Applications of the Binomial Distribution, The Poisson and Exponential Distributions, The Poisson Distribution, The Exponential Distribution.</p>			08 Hours
Module – 3			Teaching Hours
<p>Decision Making under Uncertainty: Introduction, Elements of Decision Analysis, Payoff Tables, Possible Decision Criteria, Expected Monetary Value (EMV), Sensitivity Analysis, Decision Trees, Risk Profiles, The Precision Tree Add-In, Bayes' Rule, Multistage Decision Problems and the Value of Information, The Value of Information, Risk Aversion and Expected Utility, Utility Functions, Exponential Utility, Certainty Equivalents, Is Expected Utility</p>			08 Hours

Maximization Used? Sampling and Sampling Distributions: Introduction, Sampling Terminology, Methods for Selecting Random Samples, Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Multistage Sampling Schemes, Introduction to Estimation, Sources of Estimation Error, Key Terms in Sampling, Sampling Distribution of the Sample Mean, The Central Limit Theorem, Sample Size Selection, Summary of Key Ideas for Simple Random Sampling.	
Module – 4	
Confidence Interval Estimation: Introduction, Sampling Distributions, The t Distribution, Other Sampling Distributions, Confidence Interval for a Mean, Confidence Interval for a Total, Confidence Interval for a Proportion, Confidence Interval for a Standard Deviation, Confidence Interval for the Difference between Means, Independent Samples, Paired Samples, Confidence Interval for the Difference between Proportions, Sample Size Selection, Sample Size Selection for Estimation of the Mean, Sample Size Selection for Estimation of Other Parameters. Hypothesis Testing: Introduction,Concepts in Hypothesis Testing, Null and Alternative Hypothesis, One-Tailed Versus Two-Tailed Tests, Types of Errors, Significance Level and Rejection Region, Significance from p-values, Type II Errors and Power, Hypothesis Tests and Confidence Intervals, Practical versus Statistical Significance, Hypothesis Tests for a Population Mean, Hypothesis Tests for Other Parameters, Hypothesis Tests for a Population Proportion, Hypothesis Tests for Differences between Population Means, Hypothesis Test for Equal Population Variances, Hypothesis Tests for Difference between Population Proportions, Tests for Normality, Chi-Square Test for Independence.	08 Hours
Module – 5	
Regression Analysis: Estimating Relationships: Introduction, Scatterplots : Graphing Relationships, Linear versus Nonlinear Relationships,Outliers,Unequal Variance, No Relationship,Correlations:Indications of Linear Relationships, Simple Linear Regression, Least Squares Estimation, Standard Error of Estimate, The Percentage of Variation Explained:R-Square,Multiple Regression, Interpretation of Regression Coefficients, Interpretation of Standard Error of Estimate and R-Square, Modeling Possibilities, Dummy Variables, Interaction Variables, Nonlinear Transformations, Validation of the Fit. Regression Analysis: Statistical Inference: Introduction,The Statistical Model, Inferences About the Regression Coefficients, Sampling Distribution of the Regression Coefficients, Hypothesis Tests for the Regression Coefficients and p-Values, A Test for the Overall Fit: The ANOVA Table,Multicollinearity,Include/Exclude Decisions, Stepwise Regression,Outliers,Violations of Regression Assumptions,Nonconstant Error Variance,Nonnormality of Residuals,Autocorrelated Residuals ,Prediction.	08 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Explain the importance of data and data analysis • Interpret the probabilistic models for data • Illustrate hypothesis, uncertainty principle • Demonstrate the regression analysis 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module.	

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cengage Learning

Reference Books:

WIRELESS NETWORKS AND MOBILE COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VI

Subject Code	17CS663	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Module – 1	Teaching Hours
Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices Mobile System Networks, Data Dissemination, Mobility Management, Security Cellular Networks and Frequency Reuse, Mobile Smartphone, Smart Mobiles, and Systems Handheld Pocket Computers, Handheld Devices, Smart Systems, Limitations of Mobile Devices Automotive Systems	8 Hours
Module – 2	
GSM-Services and System Architecture, Radio Interfaces of GSM, Protocols of GSM Localization, Call Handling Handover, Security, New Data Services, General Packet Radio Service High-speed Circuit Switched Data, DECT, Modulation, Multiplexing, Controlling the Medium Access Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Coding Methods, Code Division Multiple Access, IMT-2000 3G Wireless Communication Standards, WCDMA 3G Communications Standards ,CDMMA2000 3G Communication Standards, I-mode, OFDM, High Speed Packet Access (HSPA) 3G Network Long-term Evolution, WiMaxRel 1.0 IEEE 802.16e, Broadband Wireless Access, 4G Networks, Mobile Satellite Communication Networks	8 Hours
Module – 3	
IP and Mobile IP Network Layers, Packet Delivery and Handover Management Location Management, Registration, Tunnelling and Encapsulation, Route Optimization Dynamic Host Configuration Protocol, VoIP, IPsec Conventional TCP/IP Transport Layer Protocols, Indirect TCP, Snooping TCP Mobile TCP, Other Methods of Mobile TCP-layer Transmission ,TCP over 2.5G/3G Mobile Networks	8 Hours
Module – 4	
Data Organization, Database Transactional Models – ACID Rules, Query Processing Data Recovery Process, Database Hoarding Techniques , Data Caching, Client-Server Computing for Mobile Computing and Adaptation Adaptation Software for Mobile Computing, Power-Aware Mobile Computing, Context-aware Mobile Computing	8 Hours
Module – 5	
Communication Asymmetry, Classification of Data-delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing techniques, Digital Audio Broadcasting (DAB), Digital Video Broadcasting Synchronization, Synchronization Software for Mobile Devices, Synchronization Software for Mobile Devices SyncML-Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia Markup Language (SMIL)	8 Hours
Course outcomes: The students should be able to:	

- Understand the various mobile communication systems.
- Describe various multiplexing systems used in mobile computing.
- Explain the use and importance of data synchronization in mobile computing

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Raj kamal: Mobile Computing, 2ND EDITION, Oxford University Press, 2007/2012
2. MartynMallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

PYTHON APPLICATION PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VI

Subject Code	17CS664	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Module – 1	Teaching Hours
Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions	8 Hours
Module – 2	
Iteration, Strings, Files	8 Hours
Module – 3	
Lists, Dictionaries, Tuples, Regular Expressions	8 Hours
Module – 4	
Classes and objects, Classes and functions, Classes and methods	8 Hours
Module – 5	
Networked programs, Using Web Services, Using databases and SQL	8 Hours

Course outcomes: The students should be able to:

- Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (<http://greenteapress.com/thinkpython2/thinkpython2.pdf>) (Chapters 15, 16, 17)(Download pdf files from the above links)

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, “Programming Python”, 4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873

3. Wesley J Chun, “Core Python Applications Programming”, 3rdEdition, Pearson Education India, 2015. ISBN-13: 978-9332555365
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”, 1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
5. ReemaThareja, “Python Programming using problem solving approach”, Oxford university press, 2017

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS665	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
SOA BASICS:Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise-Wide SOA, Strawman Architecture For Enterprise-Wide-SOA-Enterprise, SOA-Layers, Application Development Process, SOA Methodology For Enterprise Text 1: Ch2: 2.1 – 2.4; Ch3:3.1-3.7; Ch4: 4.1 – 4.5			8 Hours
Module – 2			
Enterprise Applications; Architecture Considerations, Solution Architecture for enterprise application, Software platforms for enterprise Applications; Package Application Platforms, Enterprise Application Platforms, Service-oriented-Enterprise Applications; Considerations for Service-Oriented Enterprise Applications, Patterns for SOA, Pattern-Based Architecture for Service-Oriented Enterprise Application(java reference model only).Composite Applications, SOA programming models. Text 1: Ch5:5.1, 5.2, 6.1, 6.2(PageNo 74-81), 7.1 – 7.5			8 Hours
Module – 3			
SOA ANALYSIS AND DESIGN; Need For Models, Principles of Service Design, Design of Activity Services, Design of Dataservices, Design of Client services and Design of business process services, Technologies of SOA; Technologies For Service Enablement, Technologies For Service Integration, Technologies for Service orchestration. Text 1: Ch 8: 8.1 – 8.6, 9.1 – 9.3			8 Hours
Module – 4			
Business case for SOA; Stakeholder OBJECTIVES, Benefits of SOA, Cost Savings, Return on Investment, SOA Governance, Security and implementation; SOA Governance, SOA Security, approach for enterprise wide SOA implementation, Trends in SOA; Technologies in Relation to SOA, Advances in SOA. Text 1: Ch 10: 10.1 -10.4, Ch 11: 11.1 to 11.3, Ch12:12.2, 12.3			8 Hours
Module – 5			
SOA Technologies-PoC; Loan Management System(LMS), PoC-Requirements Architectures of LMS SOA based integration; integrating existing application, SOA best practices, Basic SOA using REST. Role of WSDL,SOAP and JAVA/XML Mapping in SOA. Text 1:Page No 245-248; ReferenceBook:Chapter3; Text 1:Page No 307-310 Text 2: Ch 3, Ch4			8 Hours
Course outcomes: The students should be able to:			

- Understand the different IT architectures
- Explain SOA based applications
- Illustrate web service and realization of SOA
- Discuss RESTful services

Question paper pattern:

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley Second Edition, 2014.
2. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.

Reference Books:

1. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

MULTI-CORE ARCHITECTURE AND PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 -2018) SEMESTER – VI			
Subject Code	17CS666	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl’s Law, Growing Returns: Gustafson’s Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.			8 Hours
Module – 2			Teaching Hours
Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You’ll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features			8 Hours
Module – 3			Teaching Hours
Threading APIs :ThreadingAPIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.			8 Hours
Module – 4			Teaching Hours
OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance			8 Hours
Module – 5			Teaching Hours
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks,			8 Hours

Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify the issues involved in multicore architectures • Explain fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Discuss salient features of different multicore architectures and how they exploit parallelism • Illustrate OpenMP and programming concept 	
Question paper pattern:	
<p>The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.</p>	
Text Books:	
1. Multicore Programming , Increased Performance through Software Multi-threading by ShameemAkhter and Jason Roberts , Intel Press , 2006	
Reference Books:	
NIL	

SYSTEM SOFTWARE AND OPERATING SYSTEM LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VI

Subject Code	17CSL67	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

Exercises to be prepared with minimum three files (Where ever necessary):

- i. Header file.
- ii. Implementation file.
- iii. Application file where main function will be present.

The idea behind using three files is to differentiate between the developer and user sides. In the developer side, all the three files could be made visible. For the user side only header file and application files could be made visible, which means that the object code of the implementation file could be given to the user along with the interface given in the header file, hiding the source file, if required. Avoid I/O operations (printf/scanf) and use *data input file* where ever it is possible

Lab Experiments:

1.
 - a) Write a LEX program to recognize valid *arithmetic expression*. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.
 - b) Write YACC program to evaluate *arithmetic expression* involving operators: +, -, *, and /
2. Develop, Implement and Execute a program using YACC tool to recognize all strings ending with *b* preceded by *na*'s using the grammar $a^n b$ (note: input *n* value)
3. Design, develop and implement YACC/C program to construct *Predictive / LL(1) Parsing Table* for the grammar rules: $A \rightarrow aBa$, $B \rightarrow bB / \epsilon$. Use this table to parse the sentence: *abba*\$
4. Design, develop and implement YACC/C program to demonstrate *Shift Reduce Parsing* technique for the grammar rules: $E \rightarrow E+T / T$, $T \rightarrow T * F / F$, $F \rightarrow (E) / id$ and parse the sentence: *id + id * id*.
5. Design, develop and implement a C/Java program to generate the machine code using *Triples* for the statement $A = -B * (C + D)$ whose intermediate code in three-address form:

$$T1 = -B$$

$$T2 = C + D$$

$$T3 = T1 + T2$$

$$A = T3$$
6. a) Write a LEX program to eliminate *comment lines* in a C program and copy the

resulting program into a separate file.

b) Write YACC program to recognize valid *identifier, operators and keywords* in the given text (*C program*) file.

7. Design, develop and implement a C/C++/Java program to simulate the working of Shortest remaining time and Round Robin (RR) scheduling algorithms. Experiment with different quantum sizes for RR algorithm.
8. Design, develop and implement a C/C++/Java program to implement Banker's algorithm. Assume suitable input required to demonstrate the results.
9. Design, develop and implement a C/C++/Java program to implement page replacement algorithms LRU and FIFO. Assume suitable input required to demonstrate the results.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

- Implement and demonstrate Lexer's and Parser's
- Implement different algorithms required for management, scheduling, allocation and communication used in operating system.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **15 + 70 + 15 (100)**
- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero**

COMPUTER GRAPHICS LABORATORY WITH MINI PROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VI			
Subject Code	17CSL68	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 02			
Description (If any):			
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Lab Experiments:			
PART A			
Design, develop, and implement the following programs using OpenGL API			
<ol style="list-style-type: none"> 1. Implement Brenham's line drawing algorithm for all types of slope. Refer:Text-1: Chapter 3.5 Refer:Text-2: Chapter 8 2. Create and rotate a triangle about the origin and a fixed point. Refer:Text-1: Chapter 5-4 3. Draw a colour cube and spin it using OpenGL transformation matrices. Refer:Text-2: Modelling a Coloured Cube 4. Draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Refer:Text-2: Topic: Positioning of Camera 5. Clip a lines using Cohen-Sutherland algorithm Refer:Text-1: Chapter 6.7 Refer:Text-2: Chapter 8 6. To draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene. Refer:Text-2: Topic: Lighting and Shading 7. Design, develop and implement recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user. Refer: Text-2: Topic:sierpinski gasket. 8. Develop a menu driven program to animate a flag using Bezier Curve algorithm Refer: Text-1: Chapter 8-10 9. Develop a menu driven program to fill the polygon using scan line algorithm 			
Project:			
PART –B (MINI-PROJECT) :			
<p>Student should develop mini project on the topics mentioned below or similar applications using Open GL API. Consider all types of attributes like color, thickness, styles, font, background, speed etc., while doing mini project.</p> <p>(During the practical exam: the students should demonstrate and answer Viva-Voce)</p> <p>Sample Topics: Simulation of concepts of OS, Data structures, algorithms etc.</p>			
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Apply the concepts of computer graphics • Implement computer graphics applications using OpenGL • Implement real world problems using OpenGL 			
Conduction of Practical Examination:			

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 40 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: **09 + 42 +09 =60 Marks**
 - b) Part B: Demonstration + Report + Viva voce = **20+14+06 = 40 Marks**
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Reference books:

1. Donald Hearn & Pauline Baker: Computer Graphics-OpenGL Version,3rd Edition, Pearson Education,2011
2. Edward Angel: Interactive computer graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2011
3. M MRaikar, Computer Graphics using OpenGL, Fillip Learning / Elsevier, Bangalore / New Delhi (2013)

WEB TECHNOLOGY AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS71	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.			10 Hours
Module – 2			Teaching Hours
HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility, Microformats, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.			10 Hours
Module – 3			Teaching Hours
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions			10 Hours
Module – 4			Teaching Hours
PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling			10 Hours
Module – 5			Teaching Hours
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Define HTML and CSS syntax and semantics to build web pages. • Understand the concepts of Construct , visually format tables and forms using HTML using CSS • Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically. • List the principles of object oriented development using PHP • Illustrate JavaScript frameworks like jQuery and Backbone which facilitates 			

developer to focus on core features.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Randy Connolly, Ricardo Hoar, "**Fundamentals of Web Development**", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

- 1) Robin Nixon, "**Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5**", 4thEdition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
- 2) Luke Welling, Laura Thomson, "**PHP and MySQL Web Development**", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
- 3) Nicholas C Zakas, "**Professional JavaScript for Web Developers**", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
- 4) David Sawyer Mcfarland, "**JavaScript & jQuery: The Missing Manual**", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978-9351108078)
- 5) Zak Ruvalcaba Anne Boehm, "**Murach's HTML5 and CSS3**", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016. (ISBN:978-9352133246)

ADVANCED COMPUTER ARCHITECTURES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS72	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer ,Multivector and SIMD Computers ,PRAM and VLSI Models, Program and Network Properties ,Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.			10 Hours
Module – 2			
Hardware Technologies: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			10 Hours
Module – 3			
Bus, Cache, and Shared Memory ,Bus Systems ,Cache Memory Organizations ,Shared Memory Organizations ,Sequential and Weak Consistency Models ,Pipelining and Superscalar Techniques ,Linear Pipeline Processors ,Nonlinear Pipeline Processors ,Instruction Pipeline Design ,Arithmetic Pipeline Design (Upto 6.4).			10 Hours
Module – 4			
Parallel and Scalable Architectures: Multiprocessors and Multicomputers ,Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers ,Message-Passing Mechanisms ,Multivector and SIMD Computers ,Vector Processing Principles ,Multivector Multiprocessors ,Compound Vector Processing ,SIMD Computer Organizations (Upto 8.4),Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multicomputers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures.			10 Hours
Module – 5			
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers ,Dependence Analysis of Data Arrays ,Parallel Program Development and Environments, Synchronization and Multiprocessing Modes. Instruction and System Level Parallelism, Instruction Level Parallelism ,Computer Architecture ,Contents, Basic Design Issues ,Problem Definition ,Model of a Typical Processor ,Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo’s Algorithm ,Branch Prediction, Limitations in Exploiting Instruction Level Parallelism ,Thread Level Parallelism.			10 Hours
Course outcomes: The students should be able to:			

- Understand the concepts of parallel computing and hardware technologies
- Illustrate and contrast the parallel architectures
- Recall parallel programming concepts

Question paper pattern

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elsevier, 2013

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS73	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Module – 1	Teaching Hours
<p>Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.</p> <p>Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.</p> <p>Text Book1, Sections: 1.1 – 1.3, 2.1-2.5, 2.7</p>	10 Hours
Module – 2	
<p>Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.</p> <p>Text Book1, Sections: 3.1-3.7</p>	10 Hours
Module – 3	
<p>Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.</p> <p>Text book 1, Sections: 4.1 – 4.6</p>	08 Hours
Module – 4	
<p>Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm</p> <p>Text book 1, Sections: 6.1 – 6.6, 6.9, 6.11, 6.12</p>	10 Hours
Module – 5	
<p>Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.</p> <p>Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,</p> <p>Reinforcement Learning: Introduction, Learning Task, Q Learning</p> <p>Text book 1, Sections: 5.1-5.6, 8.1-8.5, 13.1-13.3</p>	12 Hours
<p>Course Outcomes: After studying this course, students will be able to</p> <ul style="list-style-type: none"> • Recall the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning. • Understand theory of probability and statistics related to machine learning • Illustrate concept learning, ANN, Bayes classifier, k nearest neighbor, Q, 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module.</p>	

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

<p style="text-align: center;">NATURAL LANGUAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII</p>			
Subject Code	17CS741	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Overview and language modeling: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications- Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			8 Hours
Module – 2			
Word level and syntactic analysis: Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			8 Hours
Module – 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			8 Hours
Module – 4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Matrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.			8 Hours
Module – 5			
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.			8 Hours

Course outcomes: The students should be able to:

- Analyze the natural language text.
- Define the importance of natural language.
- Understand the concepts Text mining.
- Illustrate information retrieval techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000.

CLOUD COMPUTING AND ITS APPLICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CS742	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Module – 1	Teaching Hours
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Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka
Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V

8 Hours

Module – 2

Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects
Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools

8 Hours

Module – 3

Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.
High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications,

8 Hours

Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka Task-Based Programming, Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module – 4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application	8 Hours
Module – 5	
Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Understand the concepts of cloud computing, virtualization and classify services of cloud computing • Illustrate architecture and programming in cloud • Define the platforms for development of cloud applications and List the application of cloud. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference Books:	
1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.	

<p style="text-align: center;">INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII</p>			
Subject Code	17CS743	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution. Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.			8 Hours
Module – 2.			
What is a Hash Function? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction. Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.			8 Hours
Module – 3			
Random number generation Providing freshness Fundamentals of entity authentication Passwords Dynamic password schemes Zero-knowledge mechanisms Further reading Cryptographic Protocols Protocol basics From objectives to a protocol Analysing a simple protocol Authentication and key establishment protocols			8 Hours
Module – 4			
Key management fundamentals Key lengths and lifetimes Key generation Key establishment Key storage Key usage Governing key management Public-Key Management Certification of public keys The certificate lifecycle Public-key management models Alternative approaches			8 Hours
Module – 5			
Cryptographic Applications Cryptography on the Internet Cryptography for wireless local area networks Cryptography for mobile telecommunications Cryptography for secure payment card transactions Cryptography for video broadcasting Cryptography for identity cards Cryptography for home users			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Analyze the Digital security lapses • Illustrate the need of key management 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Information Security: Principles and Practice, 2nd Edition by Mark Stamp Wiley 2. Everyday Cryptography: Fundamental Principles and Applications Keith M. Martin Oxford Scholarship Online: December 2013 			

Reference Books:

1. Applied Cryptography Protocols, Algorithms, and Source Code in C by Bruce Schneier

UNIX SYSTEM PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS744	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.			8 Hours
Module – 2			
UNIX Files and APIs: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.			8 Hours
Module – 3			
UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.			8 Hours
Module – 4			
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.			8 Hours
Module – 5			
Interprocess Communication : Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Understand the working of Unix Systems • Illustrate the application/service over a UNIX system. 			

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3rd Edition, Pearson Education / PHI, 2005.

Reference Books:

1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.
2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987.
3. Unix Internals - Uresh Vahalia, Pearson Education, 2001.

SOFT AND EVOLUTIONARY COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS751	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction to soft computing: ANN, FS,GA, SI, ES, Comparing among intelligent systems ANN: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems Text Book 1: Chapter1: 1.1-1.8, Chapter2: 2.1-2.6			8 Hours
Module – 2			
Adaline, Medaline, ANN: (2 nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problems Text Book 1: Chapter2: 3.1,3.2,3.3,3.6,3.7,3.10,3.11			8 Hours
Module – 3			
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy set operations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems Text Book 1: Chapter 5			8 Hours
Module – 4			
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems Text Book 1: Chapter 7			8 Hours
Module – 5			
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence(PSO). Text Book 1: 8.1-8.4, 8.7			8 Hours
Course outcomes: The students should be able to: <ul style="list-style-type: none"> • Understand soft computing techniques • Apply the learned techniques to solve realistic problems • Differentiate soft computing with hard computing techniques 			
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books: 1. Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015			
Reference Books: 1. Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, 2011.			

COMPUTER VISION AND ROBOTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS752	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			8 Hours
Module – 2			Teaching Hours
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			8 Hours
Module – 3			Teaching Hours
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			8 Hours
Module – 4			Teaching Hours
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			8 Hours
Module – 5			Teaching Hours
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis 			

- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

2. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

DIGITAL IMAGE PROCESSING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS753	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.			8 Hours
Module – 2			
Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.			8 Hours
Module – 3			
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT , Discrete Cosine Transform (DCT), Image filtering in frequency domain.			8 Hours
Module – 4			
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.			8 Hours
Module – 5			
Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.			8 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain fundamentals of image processing • Compare transformation algorithms • Contrast enhancement, segmentation and compression techniques 			
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books: <ol style="list-style-type: none"> 1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008. 			
Reference Books: <ol style="list-style-type: none"> 1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India 			

Ltd, Fourth Edition.

2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VII			
Subject Code	17CS754	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Storage System Introduction to evolution of storage architecture, key data center elements, virtualization, and cloud computing. Key data center elements – Host (or compute), connectivity, storage, and application in both classic and virtual environments. RAID implementations, techniques, and levels along with the impact of RAID on application performance. Components of intelligent storage systems and virtual storage provisioning and intelligent storage system implementations.			8 Hours
Module – 2			
Storage Networking Technologies and Virtualization Fibre Channel SAN components, connectivity options, and topologies including access protection mechanism ‘zoning’, FC protocol stack, addressing and operations, SAN-based virtualization and VSAN technology, iSCSI and FCIP protocols for storage access over IP network, Converged protocol FCoE and its components, Network Attached Storage (NAS) - components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.			8 Hours
Module – 3			
Backup, Archive, and Replication This unit focuses on information availability and business continuity solutions in both virtualized and non-virtualized environments. Business continuity terminologies, planning and solutions, Clustering and multipathing architecture to avoid single points of failure, Backup and recovery - methods, targets and topologies, Data deduplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection			8 Hours
Module – 4			
Cloud Computing Characteristics and benefits This unit focuses on the business drivers, definition, essential characteristics, and phases of journey to the Cloud. ,Business drivers for Cloud computing, Definition of Cloud computing, Characteristics of Cloud computing, Steps involved in transitioning from Classic data center to Cloud computing environment Services and deployment models, Cloud infrastructure components, Cloud migration considerations			8 Hours
Module – 5			
Securing and Managing Storage Infrastructure This chapter focuses on framework and domains of storage security along with covering security. implementation at storage networking. Security threats, and countermeasures in various domains Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle management (ILM) and storage tiering,			8 Hours

Cloud service management activities	
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Identify key challenges in managing information and analyze different storage networking technologies and virtualization • Explain components and the implementation of NAS • Describe CAS architecture and types of archives and forms of virtualization • Illustrate the storage infrastructure and management activities 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Information Storage and Management, Author :EMC Education Services, Publisher: Wiley ISBN: 9781118094839 2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company ISBN : 9780321262516 	
Reference Books:	
NIL	

MACHINE LEARNING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CSL76	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Backpropagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Study Experiment / Project:

NIL

Course outcomes: The students should be able to:

1. Understand the implementation procedures for the machine learning algorithms.

2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

Conduction of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script
- Marks distribution: Procedure + Conduction + Viva: **15 + 70 +15 (100)**

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

WEB TECHNOLOGY LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VII

Subject Code	17CSL77	IA Marks	40
Number of Lecture Hours/Week	01I + 02P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Description (If any):

NIL

Lab Experiments:

PART A

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
 - a. Parameter: A string
 - b. Output: The position in the string of the left-most vowel
 - c. Parameter: A number
 - d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
 - a. Implement simple calculator operations.
 - b. Find the transpose of a matrix.
 - c. Multiplication of two matrices.
 - d. Addition of two matrices.
9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:
 - a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named statesList.

- b. Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. [Note: Passing re.I as a second parameter to method compile performs a case-insensitive comparison.] Store this word in element 1 of statesList.
 - c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.
 - d. Search for a word in states that ends in a. Store this word in element 3 of the list.
10. Write a PHP program to sort the student records which are stored in the database using selection sort.

Study Experiment / Project:

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Note:

1. In the examination each student picks one question from part A.
2. A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.
3. The team must submit a brief project report (15-20 pages) that must include the following
 - a. Introduction
 - b. Requirement Analysis
 - c. Software Requirement Specification
 - d. Analysis and Design
 - e. Implementation
 - f. Testing

Course outcomes: The students should be able to:

- Design and develop dynamic web pages with good aesthetic sense of designing and latest technical know-how's.
- Understand the concepts of Web Application Terminologies, Internet Tools other web services.
- Recall how to link and publish web sites

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 40 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
 - a) Part A: Procedure + Conduction + Viva: **09 + 42 + 09 = 60 Marks**
 - b) Part B: Demonstration + Report + Viva voce **20+14+06 = 40 Marks**

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

INTERNET OF THINGS TECHNOLOGY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 - 2018)
SEMESTER – VIII

Subject Code	17CS81	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			10 Hours
Module – 2			
Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.			10 Hours
Module – 3			
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.			10 Hours
Module – 4			
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment			10 Hours
Module – 5			
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.			10 Hours
Course Outcomes: After studying this course, students will be able to			
<ul style="list-style-type: none"> • Interpret the impact and challenges posed by IoT networks leading to new architectural models. • Compare and contrast the deployment of smart objects and the technologies to connect them to network. 			

- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Question paper pattern:

The question paper will have ten questions.
 There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "**IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things**", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "**Internet of Things**", CENGAGE Learning India, 2017

Reference Books:

1. Vijay Madiseti and ArshdeepBahga, "**Internet of Things (A Hands-on-Approach)**", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "**Internet of Things: Architecture and Design Principles**", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

BIG DATA ANALYTICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS82	IA Marks	40
Number of Lecture Hours/Week	4	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Module – 1			Teaching Hours
Hadoop Distributed File System Basics, Running Example Programs and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming			10 Hours
Module – 2			
Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures			10 Hours
Module – 3			
Business Intelligence Concepts and Application, Data Warehousing, Data Mining, Data Visualization			10 Hours
Module – 4			
Decision Trees, Regression, Artificial Neural Networks, Cluster Analysis, Association Rule Mining			10 Hours
Module – 5			
Text Mining, Naïve-Bayes Analysis, Support Vector Machines, Web Mining, Social Network Analysis			10 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Explain the concepts of HDFS and MapReduce framework • Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration • Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making • Infer the importance of core data mining techniques for data analytics • Compare and contrast different Text Mining Techniques 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Douglas Eadline, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem ", 1 st Edition, Pearson Education, 2016. ISBN-13: 978-9332570351			
2. Anil Maheshwari, " Data Analytics ", 1 st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180			
Reference Books:			
1) Tom White, " Hadoop: The Definitive Guide ", 4 th Edition, O'Reilly Media, 2015. ISBN-13: 978-9352130672			
2) Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, " Professional Hadoop			

Solutions", 1st Edition, Wrox Press, 2014 ISBN-13: 978-8126551071

- 3) Eric Sammer, "**Hadoop Operations: A Guide for Developers and Administrators**", 1st Edition, O'Reilly Media, 2012. ISBN-13: 978-9350239261

HIGH PERFORMANCE COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS831	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi-scale, multi-discipline applications)			08 Hours
Module – 2			
High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built			08 Hours
Module – 3			
Parallel Algorithms: Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques			08 Hours
Module – 4			
Parallel Programming: Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays)			08 Hours
Module – 5			
Achieving Performance: Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks			08 Hours
Course outcomes: The students should be able to:			
<ul style="list-style-type: none"> • Illustrate the key factors affecting performance of CSE applications • Illustrate mapping of applications to high-performance computing systems • Apply hardware/software co-design for achieving performance on real-world applications 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			

Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
3. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
4. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
5. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
6. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
7. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

USER INTERFACE DESIGN
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VIII

Subject Code	17CS832	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students			
<ul style="list-style-type: none"> • To study the concept of menus, windows, interfaces. • To study about business functions. • To study the characteristics and components of windows and the various controls for the windows. • To study about various problems in window design with text, graphics. • To study the testing methods. 			
Module –1			Teaching Hours
The User Interface-Introduction, Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristics of graphical and web user interfaces, Principles of user interface design.			08 Hours
Module –2			
The User Interface Design process- Obstacles, Usability, Human characteristics in Design, Human Interaction speeds, Business functions-Business definition and requirement analysis, Basic business functions, Design standards.			08 Hours
Module –3			
System menus and navigation schemes- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Selecting menu choices, Navigating menus, Kinds of graphical menus.			08 Hours
Module–4			
Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Organizing window functions, Window operations, Web systems, Characteristics of device based controls.			08 Hours
Module–5			
Screen based controls- Operable control, Text control, Selection control, Custom control, Presentation control, Windows Tests-prototypes, kinds of tests.			08 Hours
Course outcomes: The Students should be able to:			
<ul style="list-style-type: none"> • Design the User Interface, design, menu creation ,windows creation and connection between menus and windows. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			
Text Book:			
1. Wilbert O. Galitz, “The Essential Guide to User Interface Design”, John Wiley & Sons, Second Edition 2002.			

Reference Books:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.
2. Alan Cooper, "The Essential of User Interface Design", Wiley- Dream Tech Ltd.,2002

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS833	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			8 Hours
Module – 2			
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			8 Hours
Module – 3			
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			8 Hours
Module – 4			
Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the			8 Hours

ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
Module – 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, CaseBased Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	8 Hours
Course outcomes: The students should be able to:	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Infer SNMP for managing the network • Infer RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010. 	
Reference Books:	
<ol style="list-style-type: none"> 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008. 	

SYSTEM MODELLING AND SIMULATION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2017 - 2018) SEMESTER – VIII			
Subject Code	17CS834	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Module – 1			Teaching Hours
Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. General Principles, Simulation Software: Concepts in Discrete-Event Simulation. The Event-Scheduling / Time-Advance Algorithm, Manual simulation Using Event Scheduling			08 Hours
Module – 2			Teaching Hours
Statistical Models in Simulation : Review of terminology and concepts, Useful statistical models,Discrete distributions. Continuous distributions,Poisson process, Empirical distributions. Queuing Models: Characteristics of queuing systems,Queuing notation,Long-run measures of performance of queuing systems,Long-run measures of performance of queuing systems cont...,Steady-state behavior of M/G/1 queue, Networks of queues,			08 Hours
Module – 3			Teaching Hours
Random-NumberGeneration: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers,Tests for Random Numbers, Random-Variate Generation: ,Inverse transform technique Acceptance-Rejection technique.			08 Hours
Module – 4			Teaching Hours
Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, Contd..			08 Hours
Module – 5			Teaching Hours
Measures of performance and their estimation,Output analysis for terminating simulations Continued..,Output analysis for steady-state simulations. Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models,Calibration and validation of models, Optimization via Simulation.			08 Hours
Course outcomes: The students should be able to:			

- Explain the system concept and apply functional modeling method to model the activities of a static system
- Describe the behavior of a dynamic system and create an analogous model for a dynamic system;
- Illustrate the operation of a dynamic system and make improvement according to the simulation results.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGraw-Hill, 2007

INTERNSHIP / PROFESSIONAL PRACTISE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CS84	IA Marks	50
Duration	4 weeks	Exam Marks	50
		Exam Hours	03

CREDITS – 02

Description (If any):

With reference to the above subject, this is to inform that the following are the guidelines to be followed for the Internship Programme and the earlier circular as cited in ref (i) is hereby withdrawn:

1) As per the 15OB.9 the Internship Programme duration is of Eight weeks. However it has been reduced to Four weeks and it should be carried out between (VI and VII Semester) Vacation and/or (VII and VIII Semester) Vacation.

2) The internship can be carried out in any Industry/R and D Organization/Research Institute/ Educational institute of repute.

3) The Institutions may also suggest the students to enrol for the Internshala platform for free internships as there is a MoU with the AICTE for the beneficial of the affiliated Institutions (<https://internshala.com/>)

4) The Examination of Internship will be carried out in line with the University Project Viva-voce examination.

5) (a) The Department/college shall nominate staff member/s to facilitate, guide and supervise students under internship. (b) The Internal Guide has to visit place of internship at least once during the student's internship.

6) The students shall report the progress of the internship to the guide in regular intervals and seek his/her advice.

7) After the completion of Internship, students shall submit a report with completion and attendance certificates to the Head of the Department with the approval of both internal and external guides.

8) The Examination of Internship will be carried out in line with the University Project Viva-voce examination.

9) There will be 50 marks for CIE (Seminar: 25, Internship report: 25) and 50 marks for Viva – Voce conducted during SEE. The minimum requirement of CIE marks shall be 50% of the maximum marks.

10) The internal guide shall award the marks for seminar and internship report after evaluation. He/she will also be the internal examiner for Viva – Voce conducted during SEE.

11) The external guide from the industry shall be an examiner for the viva voce on Internship. Viva-Voce on internship shall be conducted at the college and the date of Viva-Voce shall be fixed in consultation with the external Guide. The Examiners shall jointly award the Viva - Voce marks.

12) In case the external Guide expresses his inability to conduct viva voce, the Chief Superintendent of the institution shall appoint a senior faculty of the Department to conduct viva-voce along with the internal guide. The same shall be informed in writing to the concerned Chairperson, Board of Examiners (BOE).

13) The students are permitted to carry out the internship anywhere in India or abroad. The University will not provide any kind of financial assistance to any student for carrying out the Internship.

Course outcomes: The students should be able to:

1. Adapt easily to the industry environment
2. Take part in team work
3. Make use of modern tools
4. Decide upon project planning and financing.
5. Adapt ethical values.
6. Motivate for lifelong learning

PROJECT WORK PHASE II
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CSP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03

CREDITS – 06

Description (If any):

- Project: Carried out at the Institution or at an Industry.
- Project work shall preferably be batch wise, the strength of each batch shall not exceed maximum of four students
- Viva-voce examination in project work shall be conducted batch-wise.
- For Project Phase –I and Project seminar and Project Phase –II, the CIE shall be 100 respectively.
- The CIE marks in the case of projects in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project guide.
- Minimum requirement of CIE marks for Project work shall be 50% of the maximum marks.
- Students failing to secure a minimum of 50% of the CIE marks in Project work shall not be eligible for the Project examination conducted by the University and they shall be considered as failed in that/those Course/s. However, they can appear for University examinations conducted in other Courses of the same semester and backlog Courses if any. Students after satisfying the prescribed minimum CIE marks in the Course/s when offered during subsequent semester shall appear for SEE.
- Improvement of CIE marks shall not be allowed in Project where the student has already secured the minimum required marks
- For a pass in a Project/Viva-voce examination, a student shall secure a minimum of 40% of the maximum marks prescribed for the University Examination. The Minimum Passing Grade in a Course is ‘E’.
- The student who desires to reject the results of a semester shall reject performance in all the Courses of the semester, irrespective of whether the student has passed or failed in any Course. However, the rejection of performance of VIII semester project shall not be permitted

Course outcomes: The students should be able to:

1. Identify a issue and derive problem related to society, environment, economics, energy and technology
2. Formulate and Analyze the problem and determine the scope of the solution chosen
3. Determine , dissect, and estimate the parameters, required in the solution.
4. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metrics.
5. Compile the report and take part in present / publishing the finding in a reputed conference / publications
6. Attempt to obtain ownership of the solution / product developed.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2017 -2018)
SEMESTER – VIII

Subject Code	17CSS86	IA Marks	100
Number of Lecture Hours/Week	04	Exam Marks	--
Total Number of Lecture Hours	--	Exam Hours	--

CREDITS – 01

Description:

- Seminar: Deliverable at the Institution under the supervision of a Faculty.
- Seminar is one of the head of passing. i) Each candidate shall deliver seminar as per the Scheme of Teaching and Examination on the topics chosen from the relevant fields for about 30 minutes. ii) The Head of the Department shall make arrangements for conducting seminars through concerned faculty members of the Department. The committee constituted for the purpose by the Head of the Department shall award the CIE marks for the seminar. The committee shall consist of three faculty from the Department and the senior most acting as the Chairman/Chairperson. [To be read along with 17 OB 8.6]
- For Technical seminar, the CIE marks shall be 100.
- The CIE marks in the case of projects and seminars in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project / seminar guide.
- For seminar, the minimum requirement of CIE marks shall be 40% of the maximum marks.
- If any student fails to secure a minimum of 40% of the maximum CIE marks in seminar/ fails to deliver the seminar, he/she shall be considered as failed in that Course and shall not be eligible for the award of degree. However, the student shall become eligible for the award of degree after satisfying the requirements prescribed for seminar during the subsequent semester/s.
- Improvement of CIE marks shall not be allowed in Seminar where the student has already secured the minimum required marks.
- Seminar topics must be from recent advancements in the domain.
- Each candidate must submit three copies of the report to the department. One for the candidate, one for the guide and one for the department.

Course outcomes: The students should be able to:

- Survey the changes in the technologies relevant to the topic selected
- Discuss the technology and interpret the impact on the society, environment and domain.
- Compile report of the study and present to the audience, following the ethics.

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
III SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 31	Engg. Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Ckts	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10IT– 35	Electronic Instrumentation	@	04		03	25	100	125
10ES – 36	Field Theory	@	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
IV SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teach Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 41	Engg. Mathematics – IV	Mat	04		03	25	100	125
10ES- 42	Microcontrollers	@	04		03	25	100	125
10ES – 43	Control Systems	@	04		03	25	100	125
10EC – 44	Signals & Systems	@	04		03	25	100	125
10EC– 45	Fundamentals of HDL	@	04		03	25	100	125
10EC – 46	Linear ICs & Applications	@	04		03	25	100	125
10ESL – 47	Microcontrollers Lab	@		03	03	25	50	75
10ECL – 48	HDL Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. **ES (for theory) & ECL (for Lab)** in the subject code indicates that the subject is common to electrical and electronics stream consisting of **EE/EC/IT/TC/ML/BM branches** of engineering.

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

V SEMESTER

COMMON TO EC/TE

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	EC	4	-	3	25	100	125
02	10EC52	Digital Signal Processing	EC	4	-	3	25	100	125
03	10EC53	Analog Communication	EC	4	-	3	25	100	125
04	10EC54	Microwaves and Radar	EC	4	-	3	25	100	125
05	10EC55	Information Theory and Coding	EC	4	-	3	25	100	125
06	10EC56	Fundamentals of CMOS VLSI	EC	4	-	3	25	100	125
07	10ECL57	DSP Lab	EC	-	3	3	25	50	75
08	10ECL58	Analog Communication Lab + LIC Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

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SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC61	Digital Communication	EC	4	-	3	25	100	125
2	10EC62	Microprocessors	EC	4	-	3	25	100	125
3	10EC63	Microelectronics Circuits	EC	4	-	3	25	100	125
4	10EC64	Antennas and Propagation	EC	4	-	3	25	100	125
5	10EC65	Operating Systems	EC	4	-	3	25	100	125
6	10EC66x	Elective-I (Group A)	EC	4	-	3	25	100	125
7	10ECL67	Advanced Communication Lab	EC	-	3	3	25	50	75
8	10ECL68	Microprocessor Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-1

10EC665	Data Structures Using C++
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**SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION**

VII Semester

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC71	Computer Communication Networks	EC	4	-	3	25	100	125
2	10EC72	Optical Fiber Communication	EC	4	-	3	25	100	125
3	10EC73	Power Electronics	EC	4	-	3	25	100	125
4	10EC74	Embedded System Design	EC	4	-	3	25	100	125
5	10EC75x	Elective-II (Group B)	EC	4	-	3	25	100	125
6	10EC76x	Elective-III (Group C)	EC	4	-	3	25	100	125
7	10ECL77	VLSI Lab	EC	-	3	3	25	50	75
8	10ECL78	Power Electronics Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-2	
10EC751	DSP Algorithms & Architecture
Elective-3	
10EC762	Real Time Systems

SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC81	Wireless Communication	EC	4	-	3	25	100	125
2	10EC82	Digital Switching System	EC	4	-	3	25	100	125
3	10EC83x	Elective-IV (Group D)	EC	4	-	3	25	100	125
4	10EC84x	Elective-V (Group E)	EC	4	-	3	25	100	125
5	10ECP85	Project Work	EC	-	6	3	100	100	200
6	10ECS86	Seminar	EC	-	3	-	50	-	50
TOTAL				16	09	15	250	500	750

Elective-4	
10EC833	Optical Networks
Elective-5	
10EC843	GSM

ENGINEERING MATHEMATICS – III

Sub Code	:	10MAT31	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Fourier Series

Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT 2:

Fourier Transforms

Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT 3:

Partial Differential Equations (P.D.E)

Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT 4:

Applications of P.D.E

Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

UNIT 5:

Numerical Methods

Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel

iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT 6:

Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule.
(All formulae / rules without proof).

UNIT 7:

Calculus of Variations

Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT 8:

Difference Equations and Z-transforms

Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

ANALOG ELECTRONIC CIRCUITS

(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES32	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers.

UNIT 2:

Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization.

UNIT 3:

Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits r_c model; analysis of CE configuration using h- parameter model; Relationship between h- parameter model of CE, CC and CE configuration.

UNIT 4:

Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects.

UNIT 5:

(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections.

(b) Feedback Amplifier: Feedback concept, Feedback connections type, Practical feedback circuits. Design procedures for the feedback amplifiers.

UNIT 6:

Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. Designing of Power amplifiers.

UNIT 7:

Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only)
Simple design methods of Oscillators.

UNIT 8:

FET Amplifiers: FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks.

TEXT BOOK:

1. “**Electronic Devices and Circuit Theory**”, Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 9TH Edition.

REFERENCE BOOKS:

1. ‘**Integrated Electronics**’, Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2nd Edition, 2010
2. “**Electronic Devices and Circuits**”, David A. Bell, PHI, 4th Edition, 2004
3. “**Analog Electronics Circuits: A Simplified Approach**”, U.B. Mahadevaswamy, Pearson/Saguine, 2007.

LOGIC DESIGN
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES33	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Principles of combinational logic-1: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations.

UNIT 2:

Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables.

UNIT 3:

Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders.

UNIT 4:

Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

UNIT 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The \overline{S} \overline{R} Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

UNIT 6:

Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops

UNIT 7:

Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design.

UNIT 8:

Sequential Design - II: Construction of state Diagrams, Counter Design.

TEXT BOOKS:

1. “**Digital Logic Applications and Design**”, John M Yarbrough, Thomson Learning, 2001.
2. “**Digital Principles and Design**“, Donald D Givone, Tata McGraw Hill Edition, 2002.

REFERENCE BOOKS:

1. “**Fundamentals of logic design**”, Charles H Roth, Jr; Thomson Learning, 2004.
2. “**Logic and computer design Fundamentals**”, Mono and Kim, Pearson, Second edition, 2001.
3. “**Logic Design**”, Sudhakar Samuel, Pearson/Saguine, 2007

NETWORK ANALYSIS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES34	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT 2:

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

UNIT 3:

Network Theorems – 1: Superposition, Reciprocity and Millman’s theorems.

UNIT 4:

Network Theorems - II:

Thevenin's and Norton's theorems; Maximum Power transfer theorem

UNIT 5: Resonant Circuits: Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

UNIT 6:

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

UNIT 7:

Laplace Transformation & Applications : Solution of networks, step, ramp and impulse responses, waveform Synthesis

UNIT 8:

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets.

TEXT BOOKS:

1. “**Network Analysis**”, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. “**Networks and systems**”, Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.

REFERENCE BOOKS:

1. “**Engineering Circuit Analysis**”, Hayt, Kemmerly and DurbinTMH 7th Edition, 2010
2. “**Basic Engineering Circuit Analysis**”, J. David Irwin / R. Mark Nelms, John Wiley, 8th ed, 2006.
3. “**Fundamentals of Electric Circuits**”, Charles K Alexander and Mathew N O Sadiku, Tata McGraw-Hill, 3 ed, 2009.

ELECTRONIC INSTRUMENTATION
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10IT35	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT – 1:

Introduction

(a) Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures.

(b) Voltmeters and Multimeters Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.

UNIT – 2:

Digital Instruments

Digital Voltmeters – Introduction, DVM's based on $V - T$, $V - F$ and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time.

UNIT – 3:

Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch.

UNIT – 4:

Special Oscilloscopes

Delayed time-base oscilloscopes, Analog storage, Sampling and Digital storage oscilloscopes.

UNIT – 5:

Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer.

UNIT – 6:

Measurement of resistance, inductance and capacitance

Whetstone's bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection

UNIT – 7:

Transducers - I

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT.

UNIT – 8:

Miscellaneous Topics

(a) Transducers - II –Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple .

(b) Display devices: Digital display system, classification of display, Display devices, LEDs, LCD displays.

(c) Bolometer and RF power measurement using Bolometer

(d) Introduction to Signal conditioning.

(e) Introduction to LabView.

TEXT BOOKS:

1. **“Electronic Instrumentation”**, H. S. Kalsi, TMH, 3rd 2010
2. **“Electronic Instrumentation and Measurements”**, David A Bell, PHI / Pearson Education, 2006.

REFERENCE BOOKS:

1. **“Principles of measurement systems”**, John P. Beatley, 3rd Edition, Pearson Education, 2000
2. **“Modern electronic instrumentation and measuring techniques”**, Cooper D & A D Helfrick, PHI, 1998.
3. **Electronics & electrical measurements**, A K Sawhney, , Dhanpat Rai & sons, 9th edition.

FIELD THEORY
(Common to EC/TC/ML/EE)

Sub Code	:	10ES36	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge.

b. Electric flux density, Gauss' law and divergence: Electric flux density, Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator ∇ and divergence theorem.

UNIT 2:

a. Energy and potential : Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient , Energy density in an electrostatic field.

b. Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, capacitance and examples.

UNIT 3:

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations.

UNIT 4:

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.

UNIT 5:

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

UNIT 6:

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

UNIT 7:

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect).

UNIT 8:

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions.

TEXT BOOK:

1. **“Engineering Electromagnetics”**, William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS:

1. **“Electromagnetics with Applications”**, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999
2. **“Electromagnetic Waves And Radiating Systems,”** Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002
3. **“Field and Wave Electromagnetics”**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

ANALOG ELECTRONICS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL37	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use the Discrete components to test the circuits. LabView can be used for the verification and testing along with the above.

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.
2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)
3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)
4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for $f_0 \leq 10$ KHz
5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range $f_0 \geq 100$ KHz.
6. Testing for the performance of BJT -Crystal Oscillator for $f_0 > 100$ KHz
- 7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection
8. Testing of Clamping circuits: positive clamping /negative clamping.
9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.
10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency

11. Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.

12. Characteristics of Series and Parallel resonant circuits.

LOGIC DESIGN LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL38	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use discrete components to test and verify the logic gates. LabView can be used for designing the gates along with the above.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3. (i) Realization of parallel adder/Subtractors using 7483 chip
(ii) BCD to Excess-3 code conversion and vice versa.
4. Realization of Binary to Gray code conversion and vice versa
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.
6. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display and b) Priority encoder.
8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).
10. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
11. Wiring and testing Ring counter/Johnson counter.
12. Wiring and testing of Sequence generator.

ENGINEERING MATHEMATICS - IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Numerical Methods

Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (All formulae without Proof).

UNIT 2:

Complex Variables

Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition. Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT 3:

Complex Integration

Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only).

UNIT 4:

Series solution of Ordinary Differential Equations and Special Functions

Series solution – Frobenius method, Series solution of Bessel’s D.E. leading to Bessel function of first kind. Equations reducible to Bessel’s D.E., Series solution of Legendre’s D.E. leading to Legendre Polynomials. Rodrigue’s formula.

UNIT 5:

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem.

UNIT 6:

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson, Normal and Exponential distributions.

UNIT 7:

Sampling, Sampling distribution, Standard error. Testing of hypothesis for means. Confidence limits for means, Student's t distribution, Chi-square distribution as a test of goodness of fit.

UNIT 8:

Concept of joint probability – Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient.

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

Text book:

1. **Higher Engineering Mathematics** by Dr. B.S. Grewal, 36th Edn. Kanna Publications.
2. **Probability** by Seymour Lipschutz (Schaum's series)

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

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MICROCONTROLLERS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES42	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

UNIT 2:

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

UNIT 3:

8051 programming: Assembler directives, Assembly language programs and Time delay calculations.

UNIT 4:

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming

UNIT 5:

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .

UNIT 6:

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

Course Aim – The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultra-low power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

UNIT 7:

Motivation for MSP430 microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design).

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

Introduction to Code Composer Studio (CCS v4). Understanding how to use CCS for Assembly, C, Assembly+C projects for MSP430 microcontrollers. Interrupt programming.

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins.

UNIT 8:

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA.

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low-power programming and Interrupt.

Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces.

TEXT BOOKS:

1. “**The 8051 Microcontroller and Embedded Systems – using assembly and C**”-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006
2. “**MSP430 Microcontroller Basics**”, John Davies, Elsevier, 2008.

REFERENCE BOOKS:

1. “**The 8051 Microcontroller Architecture, Programming & Applications**”, 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.
2. “**The 8051 Microcontroller**”, V.Udayashankar and MalikarjunaSwamy, TMH, 2009
3. **MSP430 Teaching CD-ROM**, Texas Instruments, 2008 (can be requested <http://www.uniti.in>)
4. **Microcontrollers: Architecture, Programming, Interfacing and System Design**”,Raj Kamal, “Pearson Education, 2005

CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES43	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Modeling of Systems: Introduction to Control Systems, Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical systems, Friction, Translational systems (Mechanical accelerometer, systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded),

UNIT 3:

Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. Introduction to PID Controllers(excluding design)

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion.

UNIT 5:

Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci.

UNIT 6:

Frequency domain analysis: Correlation between time and frequency response, Bode plots, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. Introduction to lead, lag and lead-lag compensating networks (excluding design).

UNIT 7:

Stability in the frequency domain: Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded).

UNIT 8:

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

TEXT BOOK :

1. J. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, Fourth edition – 2005

REFERENCE BOOKS:

1. **“Modern Control Engineering “**, K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002.
2. **“Automatic Control Systems”**, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. **“Feedback and Control System”**, Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007.

SIGNALS & SYSTEMS
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10EC44	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT 2:

Time-domain representations for LTI systems – 1: Convolution, impulse response representation, Convolution Sum and Convolution Integral.

UNIT 3:

Time-domain representations for LTI systems – 2: Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT 4:

Fourier representation for signals – 1: Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties .

UNIT 5:

Fourier representation for signals – 2: Discrete and continuous Fourier transforms(derivations of transforms are excluded) and their properties.

UNIT 6:

Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling theorem and Nyquist rate.

UNIT 7:

Z-Transforms – 1: Introduction, Z – transform, properties of ROC, properties of Z – transforms, inversion of Z – transforms.

UNIT 8:

Z-transforms – 2: Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations.

TEXT BOOK

1. **Simon Haykin**, “Signals and Systems”, John Wiley India Pvt. Ltd., 2nd Edn, 2008.
2. **Michael Roberts**, “Fundamentals of Signals & Systems”, 2nd ed, Tata McGraw-Hill, 2010

REFERENCE BOOKS:

1. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, “Signals and Systems” Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
2. **H. P Hsu, R. Ranjan**, “Signals and Systems”, Scham’s outlines, TMH, 2006
3. **B. P. Lathi**, “Linear Systems and Signals”, Oxford University Press, 2005
4. **Ganesh Rao and Satish Tunga**, “Signals and Systems”, Pearson/Sanguine Technical Publishers, 2004

**FUNDAMENTALS OF HDL
(Common to EC/TC/IT/BM/ML)**

Sub Code	: 10EC45	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT 2:

Data –Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors.

UNIT 3:

Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT 4:

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT 5: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions.

Advanced HDL Descriptions: File Processing, Examples of File Processing

UNIT 6:

Mixed –Type Descriptions: Why Mixed-Type Description? VHDL User-Defined Types, VHDL Packages, Mixed-Type Description examples

UNIT 7:

Mixed –Language Descriptions: Highlights of Mixed-Language Description, How to invoke One language from the Other, Mixed-language Description Examples, Limitations of Mixed-Language Description.

UNIT 8:

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

TEXT BOOKS:

1. **HDL Programming (VHDL and Verilog)**- Nazeih M.Botros- John Wiley India Pvt. Ltd. 2008.

REFERENCE BOOKS:

1. **Fundamentals of HDL** – Cyril P.R. Pearson/Sanguin 2010.
2. **VHDL** –Douglas perry-Tata McGraw-Hill
3. **A Verilog HDL Primer**- J.Bhaskar – BS Publications
4. **Circuit Design with VHDL**-Volnei A.Pedroni-PHI

LINEAR IC's & APPLICATIONS
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10EC46	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Operational Amplifier Fundamentals: Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Op-Amps as DC Amplifiers- Biasing Op-Amps, Direct coupled -Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.

UNIT 2:

Op-Amps as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance - Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, High input impedance - Capacitor coupled Non-inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply.

UNIT 3:

Op-Amps frequency response and compensation: Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions.

UNIT 4:

OP-AMP Applications: Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, precision rectifiers, Limiting circuits.

UNIT 5:

More applications: Clamping circuits, Peak detectors, sample and hold circuits, V to I and I to V converters, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators, Wave form generator design, phase shift oscillator, Wein bridge oscillator.

UNIT 6:

Non-linear circuit applications: crossing detectors, inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Active Filters –First and second order Low pass & High pass filters.

UNIT 7:

Voltage Regulators: Introduction, Series Op-Amp regulator, IC Voltage regulators, 723 general purpose regulator, Switching regulator.

UNIT 8:

Other Linear IC applications: 555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger; PLL-operating principles, Phase detector / comparator, VCO; D/A and A/ D converters – Basic DAC Techniques, AD converters.

TEXT BOOKS:

1. “Operational Amplifiers and Linear IC’s”, David A. Bell, 2nd edition, PHI/Pearson, 2004
2. “Linear Integrated Circuits”, D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International

REFERENCE BOOKS:

1. “Opamps- Design, Applications and Trouble Shooting”, Terrell, Elsevier, 3rd ed. 2006.
2. “Operational Amplifiers”, George Clayton and Steve Winder, Elsevier 5th ed., 2008

3. “Operational Amplifiers and Linear Integrated Circuits”, Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson, 2006
4. “Design with Operational Amplifiers and Analog Integrated Circuits”, Sergio Franco, TMH, 3e, 2005

MICROCONTROLLERS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	: 10ESL47	IA Marks	: 25
Hrs/ Week	: 03	Exam Hours	: 03
Total Hrs.	: 42	Exam Marks	: 50

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430.

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

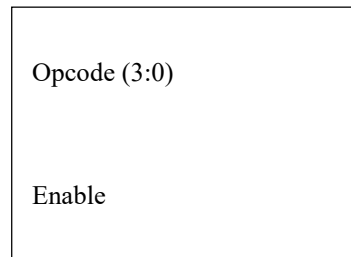
HDL LAB
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10ECL48	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/AceX/Max/Spartan/Sinfi/TK Base or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

PROGRAMMING (using VHDL /Verilog)

1. Write HDL code to realize all the logic gates
2. Write a HDL program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
2. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
3. Write a model for 32 bit ALU using the schematic diagram shown below
A (31:0) B (31:0)



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line is high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the given in example below.

OPCODE	ALU OPERATION
1.	A + B
2.	A – B
3.	A Complement
4.	A * B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

4. Develop the HDL code for the following flip-flops, SR, D, JK, T.
5. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters

INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on the given seven segment display and LCD and accepting Hex key pad input data.
2. Write HDL code to control speed, direction of DC and Stepper motor.
3. Write HDL code to accept 8 channel Analog signal, Temperature sensors and display the data on LCD panel or Seven segment display.
4. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.
5. Write HDL code to simulate Elevator operations
- 6.** Write HDL code to control external lights using relays.

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of Management - Management as a Science, Art or Profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-Early Management Approaches-Modern Management Approaches.

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

UNIT - 3

ORGANISING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees – Centralisation Vs Decentralisation of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship - Evolution of

Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI - Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

TEXT BOOKS:

1. **Principles of Management** - P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th Edition, 2010
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House.
3. **Entrepreneurship Development** - Small Business Enterprises - Poornima M Charantimath - Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development Robert Lusier – Thomson.
2. **Entrepreneurship Development** - S S Khanka - S Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education /PHI -17th Edition, 2003.

DIGITAL SIGNAL PROCESSING

Subject Code	: 10EC52	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.

UNIT - 2

Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

UNIT - 3

Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).

UNIT - 4

Radix-2 FFT algorithm for the computation of DFT and IDFT—decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform

UNIT - 5

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations.

UNIT - 6

Implementation of discrete-time systems: Structures for IIR and FIR systems- direct form I and direct form II systems, cascade, lattice and parallel realization.

UNIT - 7

FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlett and Kaiser windows, FIR filter design using frequency sampling technique.

UNIT - 8

Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

TEXT BOOK:

1. **Digital signal processing – Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. **Digital Signal Processing**, Lee Tan: Elsvier publications, 2007

ANALOG COMMUNICATION

Subject Code	: 10EC53	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

UNIT - 2

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

UNIT - 3

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves.

UNIT - 4

VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

UNIT - 5

ANGLE MODULATION (FM)-I: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

UNIT - 6

ANGLE MODULATION (FM)-II: Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

UNIT - 7

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

UNIT - 8

NOISE IN CONTINUOUS WAVE MODULATION SYSTEMS: Introduction, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM,.

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 5th Edition, John Wiley, India Pvt. Ltd, 2009.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, Oxford University Press., 4th ed, 2010,
2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. **Communication Systems**: Singh and Sapre: Analog and digital TMH 2nd , Ed 2007.

MICROWAVES AND RADAR

Subject Code	: 10EC54	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MICROWAVE TRANSMISSION LINES: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors.

UNIT - 2

MICROWAVE WAVEGUIDES AND COMPONENTS: Introduction, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators.

UNIT - 3

MICROWAVE DIODES,

Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers
Other diodes: PIN diodes, Schottky barrier diodes.

UNIT - 4

Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi port networks.

UNIT - 5

Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees.

UNIT - 6

STRIP LINES: Introduction, Microstrip lines, Parallèle strip lines, Coplanar strip lines, Shielded strip Lines.

UNIT - 7

AN INTRODUCTION TO RADAR: Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, the origins of Radar.

UNIT - 8

MTI AND PULSE DOPPLER RADAR: Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

TEXT BOOKS:

1. **Microwave Devices and circuits-** Liao / Pearson Education.
2. **Introduction to Radar systems-**Merrill I Skolnik, 3rd Ed, TMH, 2001.
3. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.

REFERENCE BOOK:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.

INFORMATION THEORY AND CODING

Subject Code	: 10EC55	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

UNIT - 2

SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

UNIT - 3

FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

UNIT - 4

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT - 5

INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

UNIT - 6

Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

UNIT - 7

RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

UNIT - 8

Convolution Codes, Time domain approach. Transform domain approa

TEXT BOOKS:

1. **Digital and analog communication systems**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. **Digital communication**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **ITC and Cryptography**, Ranjan Bose, TMH, II edition, 2007
2. **Digital Communications** - Glover and Grant; Pearson Ed. 2nd Ed 2008.
- 3.

FUNDAMENTALS OF CMOS VLSI

Subject Code	: 10EC56	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

BASIC MOS TECHNOLOGY: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.

MOS TRANSISTOR THEORY: Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

UNIT - 2

CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Tutorial exercises.

Basic Physical Design of Simple logic gates.

UNIT - 3

CMOS LOGIC STRUCTURES: CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL).

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

SCALING OF MOS CIRCUITS: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

UNIT - 5

CMOS SUBSYSTEM DESIGN: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations.

Clocking Strategies

UNIT - 6

CMOS SUBSYSTEM DESIGN PROCESSES: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

UNIT - 7

MEMORY, REGISTERS AND CLOCK: Timing considerations. Memory elements. Memory cell arrays.

UNIT - 8

TESTABILITY: Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability.

TEXT BOOKS:

1. **CMOS VLSI Design – A Circuits and Systems Perspective. 3rd Edition.** N.H. Weste and David Harris. Addison-Wesley, 2005. (Refer to <http://www.cmosvlsi.com>)
2. **Principles of CMOS VLSI Design: A Systems Perspective,** Neil H. E. Weste, K. Eshragian, and ??? 3rd edition, Pearson Education (Asia) Pvt. Ltd., 200?. (Shift to the latest edition.)
3. **Basic VLSI Design -** Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994), 2005.

REFERENCE BOOKS:

1. R. Jacob Baker. CMOS Circuit Design, Layout and Simulation. John Wiley India Pvt. Ltd, 2008
2. **Fundamentals of Semiconductor Devices,** M. K. Achuthan and K. N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. **CMOS Digital Integrated Circuits: Analysis and Design,** Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
4. **Analysis and Design of Digital Integrated Circuits -** D.A Hodges, H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

DIGITAL SIGNAL PROCESSING LABORATORY

Subject Code	: 10ECL57	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

A LIST OF EXPERIMENTS USING MATLAB / SCILAB / OCTAVE / WAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system

REFERENCE BOOKS:

1. **Digital signal processing using MATLAB** - Sanjeet Mitra, TMH, 2001
2. **Digital signal processing using MATLAB** - J. G. Proakis & Ingale, MGH, 2000
3. **Digital Signal Processors**, B. Venkataramani and Bhaskar, TMH, 2002

ANALOG COMMUNICATION LAB + LIC LAB

Subject Code	: 10ECL58	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

**EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW
- 2009 CAN BE USED FOR VERIFICATION AND TESTING.**

1. Second order active LPF and HPF
2. Second order active BPF and BE
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
 - a. Astable multivibrator for given frequency and duty cycle
 - b. Monostable multivibrator for given pulse width W
7. IF amplifier design
8. Amplitude modulation using transistor/FET (Generation and detection)
9. Pulse amplitude modulation and detection
10. PWM and PPM
11. Frequency modulation using 8038/2206
12. Precision rectifiers – both Full Wave and Half Wave.

VI SEMESTER

DIGITAL COMMUNICATION

Subject Code	: 10EC61	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery.

UNIT - 2

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, robust quantization.

UNIT - 3

DPCM, DM, applications. Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals.

UNIT - 4

ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

UNIT - 5

DIGITAL MODULATION TECHNIQUES: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques.

UNIT - 6

Detection and estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

UNIT - 7

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

UNIT - 8

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency

hop spread spectrum, applications.

TEXT BOOK:

1. **Digital communications**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **Digital and Analog communication systems**, Simon Haykin, John Wiley India Pvt. Ltd, 2008
2. **An introduction to Analog and Digital Communication**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 2008.
3. **Digital communications** - Bernard Sklar: Pearson education 2007

MICROPROCESSOR

Subject Code	: 10EC62	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing, The 8086

UNIT - 2

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators

UNIT - 3

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display

UNIT - 4

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples

UNIT - 5

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor

UNIT - 6

8086 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples

UNIT - 7

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the universal serial bus (USB)

UNIT - 8

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.

TEXT BOOKS:

1. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and G. A. Gibson, 2E PHI -2003
2. **The Intel Microprocessor, Architecture, Programming and Interfacing**-Barry B. Brey, 6e, Pearson Education / PHI, 2003

REFERENCE BOOKS:

1. **Microprocessor and Interfacing- Programming & Hardware**, Douglas hall, 2nd, TMH, 2006.
2. **Advanced Microprocessors and Peripherals** - A.K. Ray and K.M. Bhurchandi, TMH, 2nd, 2006.
3. **8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware & Applications** - Triebel and Avtar Singh, 4e, Pearson Education, 2003

MICROELECTRONICS CIRCUITS

Subject Code : **10EC63**

No. of Lecture Hrs/Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

UNIT – 1

MOSFETS: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation modes, single stage MOS amplifiers. MOSFET internal capacitances and high frequency modes, Frequency response of CS amplifiers, CMOS digital logic inverter, detection type MOSFET.

UNIT -2

Single Stage IC Amplifier: IC Design philosophy, CoUmparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response.

UNIT – 3

Single Stage IC amplifiers (continued): CS and CF amplifiers with loads, high frequency response of CS and CF amplifiers, CG and CB amplifiers with active loads, high frequency response of CG and CB amplifiers, Cascade amplifiers. CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance. SPICE examples.

UNIT – 4

Differences and Multistage Amplifiers: The MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers. Multistage amplifier. SPICE examples.

UNIT – 5

Feedback. General Feedback structure. Properties of negative feedback. Four basic feedback topologies. Series-Shunt feedback. Determining the loop gain. Stability problem. Effect of feedback an amplifier poles. Stability study using Bode plots. Frequency compensation. SPICE examples.

UNIT - 6

Operational Amplifiers: The two stage CMOS Op-amp, folded cascade CMOS op-amp, 741 op-amp circuit, DC analysis of the 741, small signal analysis of 741, gain, frequency response and slew rate of 741. Data Converters. A-D and D-A converters.

UNIT – 7 & 8

Digital CMOS circuits. Overview. Design and performance analysis of CMOS inverter. Logic Gate Circuits. Pass-transistor logic. Dynamic Logic Circuits. SPICE examples.

Text Book:

1. “**Microelectronic Circuits**”, Adel Sedra and K.C. Smith, 5th Edition, Oxford University Press, Interantional Version, 2009.

Reference Book:

1. “**Fundamentals of Microelectronics**”, Behzad Razavi, John Wiley India Pvt. Ltd, 2008.
2. “**Microelectronics – Analysis and Design**”, Sundaram Natarajan, Tata McGraw-Hill, 2007

ANTENNAS AND PROPAGATION

Subject Code	: 10EC64	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna filed zones.

UNIT - 2

POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources. Endfire array and Broadside array.

UNIT - 3

ELECTRIC DIPOLES AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole(no derivation of field components), radiation resistance of short dipole, radiation resistances of $\lambda/2$ Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

UNIT - 4 & 5

LOOP, SLOT, PATCH AND HORN ANTENNA: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Babinet’s principle and complementary antennas,

impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas.

UNIT - 6

ANTENNA TYPES: Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna, high-resolution data, intelligent antennas, antenna for remote sensing.

UNIT - 7 & 8

RADIO WAVE PROPAGATION: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.

TROPOSPHERE WAVE PROPAGATION: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

TEXT BOOKS:

1. **Antennas and Wave Propagation**, John D. Krauss, 4th Edn, McGraw-Hill International edition, 2010.
2. **Antennas and Wave Propagation** - Harish and Sachidananda: Oxford Press 2007

REFERENCE BOOKS:

1. **Antenna Theory Analysis and Design** - C A Balanis, 3rd Edn, John Wiley India Pvt. Ltd, 2008
2. **Antennas and Propagation for Wireless Communication Systems** - Sineon R Saunders, John Wiley, 2003.
3. **Antennas and wave propagation** - G S N Raju: Pearson Education 2005

OPERATING SYSTEMS

Subject Code	: 10EC65	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS:

Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating

systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

UNIT - 2

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

UNIT - 3

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris.

UNIT - 4

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

UNIT - 5

VIRTUAL MEMORY: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

UNIT - 6

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

UNIT - 7

SCHEDULING: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX.

UNIT - 8

MESSAGE PASSING: Implementing message passing, Mailboxes, Inter process communication in UNIX.

TEXT BOOK:

1. **“Operating Systems - A Concept based Approach”**, D. M. Dhamdhare, TMH, 3rd Ed, 2010.

REFERENCE BOOK:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.
3. **Design of Operating Systems**, Tennambhaum, TMH, 2001.

ADVANCED COMMUNICATION LAB

Subject Code	: 10ECL67	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

LIST OF EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW – 2009 can be used for verification and testing.

1. TDM of two band limited signals.
2. ASK and FSK generation and detection
3. PSK generation and detection
4. DPSK generation and detection
5. QPSK generation and detection
6. PCM generation and detection using a CODEC Chip
7. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture
8. Analog and Digital (with TDM) communication link using optical fiber.
9. Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench
10. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).
11. Determination of coupling and isolation characteristics of a stripline (or microstrip) directional coupler
12. (a) Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate.

(b) Measurement of power division and isolation characteristics of a microstrip 3 dB power divider.

MICROPROCESSOR LAB

Subject Code	: 10ECL68	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

I) Programs involving

- 1) Data transfer instructions like:
 - i] Byte and word data transfer in different addressing modes.
 - ii] Block move (with and without overlap)
 - iii] Block interchange

- 2) Arithmetic & logical operations like:
 - i] Addition and Subtraction of multi precision nos.
 - ii] Multiplication and Division of signed and unsigned Hexadecimal nos.
 - iii] ASCII adjustment instructions
 - iv] Code conversions
 - v] Arithmetic programs to find square cube, LCM, GCD, factorial

- 3) Bit manipulation instructions like checking:
 - i] Whether given data is positive or negative
 - ii] Whether given data is odd or even
 - iii] Logical 1's and 0's in a given data
 - iv] 2 out 5 code
 - v] Bit wise and nibble wise palindrome

- 4) Branch/Loop instructions like:
 - i] Arrays: addition/subtraction of N nos.
Finding largest and smallest nos.
Ascending and descending order
 - ii] Near and Far Conditional and Unconditional jumps, Calls and Returns

- 5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.

- 6) Programs involving Software interrupts
Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console
- II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card
 - a) Matrix keyboard interfacing
 - b) Seven segment display interface
 - c) Logical controller interface
 - d) Stepper motor interface
- III) Other Interfacing Programs
 - a) Interfacing a printer to an X86 microcomputer
 - b) PC to PC Communication

ELECTIVE – GROUP A

ANALOG AND MIXED MODE VLSI DESIGN

Subject Code	: 10EC661	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

(Text Book 1)

UNIT 1

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT 2

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT 3

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

(Text Book 2)

UNIT 4:

Data Converter SNR: Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating

UNIT - 2

Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

UNIT – 3&4

SYNTHESIS FOR LOW POWER: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

UNIT – 5&6

DESIGN AND TEST OF LOW-VOLTAGE CMOS CIRCUITS: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V_{gs} , steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

UNIT - 7

LOW ENERGY COMPUTING: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

UNIT - 8

SOFTWARE DESIGN FOR LOW POWER: Introduction, sources of power dissipation, power estimation and optimization.

TEXT BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy and Sharat C Prasad, John Wiley Pvt. Ltd, 2008.

DATA STRUCTURE USING C++

Subject Code : **10EC665**

IA Marks : 25

No. of Lecture Hrs/Week : 04

Exam Hours : 03

UNIT - 1

INTRODUCTION: Functions and parameters, Dynamic memory allocation classis, Testing and debugging. Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing simulating pointers.

UNIT - 2

ARRAYS AND MATRICES: Arrays, Matrices, Special matrices spare matrices.

UNIT - 3

STACKS: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications.

UNIT - 4

Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked Linked representation, Applications.

UNIT - 5

SKIP LISTS AND HASHING: Dictionaries, Linear representation, Skip list presentation, Hash table representation.

UNIT - 6

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.

UNIT - 7

PRIORITY QUEUES: Linear lists, Heaps, Leftist trees.

UNIT-8

Search Trees: Binary search trees, B-trees, Applications.

TEXT BOOK:

1. **Data structures, Algorithms, and applications in C++** - Sartaj Sahni, McGraw Hill.2000.

REFERENCE BOOKS:

1. **Object Oriented Programming in C++** - Balaguruswamy. TMH, 1995.
2. **Programming in C++** - Balaguruswamy. TMH, 4th, 2010 .

DIGITAL SYSTEMS DESIGN USING VHDL

Subject Code	: 10EC666	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

Resolution and sampling frequency – Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi channel analog inputs. Concept of universal DAQ card – Use of timer-counter and analog outputs on the universal DAQ card.

UNIT 3

Cluster of Instruments in System: Interfacing of external instruments to a PC – RS 232C, RS – 422, RS 485 and USB standards – IEEE 488 standard – ISO –OSI model for series bus – introduction to bus protocols of MOD bus and CAN bus.

UNIT 4

Graphical Programming Environment in VI: Concepts of graphical programming – Lab-view software – Concept of VIs and sub VIs – Display types – Digital – Analog – Chart – Oscilloscope types – Loops – Case and sequence structures – Types of data – Arrays – Formulate nodes – Local and Global variables – String and file I/O.

UNIT 5

Analysis Tools and Simple Application in VI: Fourier transform – Power spectrum – Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – PID controller – CRO emulation – Simulation of a simple second order system – Generation of HTML page.

Reference Books:

1. S. Gupta and J P Gupta, "PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994
2. Peter W Gofton , "Understanding Serial Communication", Sybes International, 2000
3. Robert H. Bishop, "Learning with Lab-View" Prentice Hall, 2009
4. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
5. Ernest O. Doebelin and Dhanesh N Manik, " Measurement Systems – Application and Design", 5th Edn, TMH, 2007.

VII SEMESTER

COMPUTER COMMUNICATION NETWORKS

Subject Code	: 10EC71	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC.

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation.

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Backbone Networks, Virtual LANs

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: 10EC72	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point-to-point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT BOOKS:

1. "**Optical Fiber Communication**", Gerd Keiser, 4th Ed., MGH, 2008.
2. "**Optical Fiber Communications**", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: 10EC73	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base drive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1ϕ fully controlled converters, Dual converters, 1ϕ semi converters (all converters with R & RL load).

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with resistive loads and Inductive loads, numerical problems.

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification, Switch mode regulators – buck, boost and buck – boost regulators.

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1ϕ bridge inverter, voltage control of 1ϕ invertors, current source invertors, Variable DC link inverter.

TEXT BOOKS:

1. **“Power Electronics”** - M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
2. **“Power Electronics”** - M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

1. **“Power Electronics, Essentials and Applications”, L Umanand,** John Wiley India Pvt. Ltd, 2009.
2. **“Power Electronics”** , Daniel W. Hart, McGraw Hill, 2010.
3. **“Power Electronics”**, V Nattarasu and R.S. Anandamurthy, Pearson/Sanguine Pub. 2006.

EMBEDDED SYSTEM DESIGN

Subject Code	: 10EC74	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.

UNIT 2:

The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor
 The Hardware Side: Storage Elements and Finite-State Machines (2 hour)
 The concepts of State and Time, The State Diagram, Finite State Machines-A Theoretical Model.

UNIT 3:

Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation.

UNIT 4:

Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The

Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project.

UNIT 5 & 6:

Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited

UNIT 7 & 8:

Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance

Text Book:

1. Embedded Systems – A contemporary Design

Tool, James K. Peckol, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. **Embedded Systems: Architecture and Programming**, Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Programming for Embedded Systems**, Dreamtech Software Team, John Wiley India Pvt. Ltd, 2008

VLSI LAB

Subject Code : **10ECL77**

No. of Practical Hrs/Week : 03

Total no. of Practical Hrs. : 42

IA Marks : 25

Exam Hours : 03

Exam Marks : 50

(Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used)

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesize** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

- i. An inverter
- ii. A Buffer
- iii. Transmission Gate
- iv. Basic/universal gates
- v. Flip flop -RS, D, JK, MS, T
- vi. Serial & Parallel adder
- vii. 4-bit counter [Synchronous and Asynchronous counter]
- viii. Successive approximation register [SAR]

** An appropriate constraint should be given*

PART - B

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:

- a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis

b. **Draw the Layout** and verify the DRC, ERC

c. Check for LVS

d. Extract RC and back annotate the same and verify the Design

e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:

- a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis

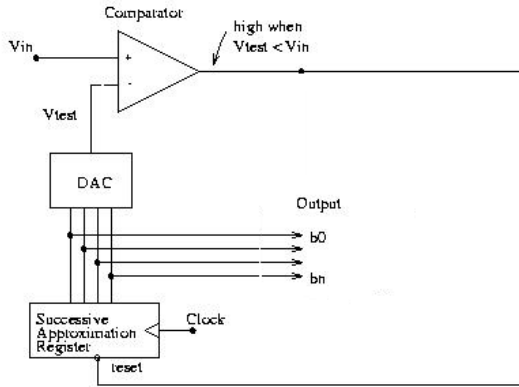
- iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier
 - ii) Common source and Common Drain amplifier

- 3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



- * Appropriate specification should be given.
- ** Applicable Library should be added & information should be given to the Designer.
- *** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: 10ECL78	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

Any five converter circuits experiment from the below list **must be** simulated using the **spice-simulator**.

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT.
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using i) LC circuit ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of a separately excited DC motor.
11. Speed control of universal motor.

12. Speed control of stepper motor.

13. Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: 10EC751	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control.

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOK:

1. **“Digital Signal Processing”**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Iffachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **“Digital Signal Processors”**, B Venkataramani and M Bhaskar TMH, 2nd, 2010
3. **“Architectures for Digital Signal Processing”**, Peter Pirsch John Wiley, 2008

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	: 10MS752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 10
			0

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

Multiple Inheritances, public, private & protected inheritance, Class scope under Inheritance.

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

REAL-TIME SYSTEMS

Subject Code	: 10EC762	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hatley and Pirbhai Method.

TEXT BOOKS:

1. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: 10EC81	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2nd, 2009.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, “**Wireles and Mobile Network concepts and protocols**”, John Wiley India Pvt. Ltd, 1st edition, 2010.
5. “**Wireless Communication – Principles & Practice**”, T.S. Rappaport, PHI 2001.

DIGITAL SWITCHING SYSTEMS

Subject Code	: 10EC82	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis.

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis.

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood: Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India Pvt. Ltd, 3rd Ed, 2008.

ELECTIVE –4 (GROUP D)

DISTRIBUTED SYSTEM

Subject Code	: 10EC831	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Client-server communication, Group communication.

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

UNIT - 2

SYMMETRIC CIPHERS: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

UNIT - 3

Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions.

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard.

UNIT - 5

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.

UNIT - 6

Intruders, Intrusion Detection, Password Management.

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures.

UNIT - 8

Firewalls Design Principles, Trusted Systems.

TEXT BOOK:

1. **Cryptography and Network Security**, William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

OPTICAL NETWORKS

Subject Code

: **10EC833**

IA Marks

: 25

No. of Lecture Hrs/Week : 04
Total no. of Lecture Hrs. : 52

Exam Hours : 03
Exam Marks : 100

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons.

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers.

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters.

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks.

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations.

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment

considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

TEXT BOOK:

1. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

1. **Optical Communication Networks:** Biswajit Mukherjee: TMG 1998.
2. **Optical Networks,** Ulysees Black: Pearson education 2007.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: 10EC834	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE:

Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV.

UNIT - 5

GSM

Subject Code	: 10EC843	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers.

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna.

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. **MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services.

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

TEXT BOOK:

1. **“Principles of Applications of GSM”**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication**, [Friedhelm Hillebrand](#), John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: 10EC844	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols.

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT - 6

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a transport layer protocol

for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning.

UNIT - 8

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

TEXT BOOK:

1. “Ad hoc wireless Networks”, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. “Ad hoc wireless Networks”, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. “Ad hoc wireless Networking”, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: 10EC845	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens , sampling and quantization, image enhancement, image restoration.

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring.

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations.

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
III SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 31	Engg. Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Ckts	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10IT– 35	Electronic Instrumentation	@	04		03	25	100	125
10ES – 36	Field Theory	@	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
IV SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teach Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 41	Engg. Mathematics – IV	Mat	04		03	25	100	125
10ES- 42	Microcontrollers	@	04		03	25	100	125
10ES – 43	Control Systems	@	04		03	25	100	125
10EC – 44	Signals & Systems	@	04		03	25	100	125
10EC– 45	Fundamentals of HDL	@	04		03	25	100	125
10EC – 46	Linear ICs & Applications	@	04		03	25	100	125
10ESL – 47	Microcontrollers Lab	@		03	03	25	50	75
10ECL – 48	HDL Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. **ES (for theory) & ECL (for Lab)** in the subject code indicates that the subject is common to electrical and electronics stream consisting of **EE/EC/IT/TC/ML/BM branches** of engineering.

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

V SEMESTER

COMMON TO EC/TE

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	EC	4	-	3	25	100	125
02	10EC52	Digital Signal Processing	EC	4	-	3	25	100	125
03	10EC53	Analog Communication	EC	4	-	3	25	100	125
04	10EC54	Microwaves and Radar	EC	4	-	3	25	100	125
05	10EC55	Information Theory and Coding	EC	4	-	3	25	100	125
06	10EC56	Fundamentals of CMOS VLSI	EC	4	-	3	25	100	125
07	10ECL57	DSP Lab	EC	-	3	3	25	50	75
08	10ECL58	Analog Communication Lab + LIC Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

1

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC61	Digital Communication	EC	4	-	3	25	100	125
2	10EC62	Microprocessors	EC	4	-	3	25	100	125
3	10EC63	Microelectronics Circuits	EC	4	-	3	25	100	125
4	10EC64	Antennas and Propagation	EC	4	-	3	25	100	125
5	10EC65	Operating Systems	EC	4	-	3	25	100	125
6	10EC66x	Elective-I (Group A)	EC	4	-	3	25	100	125
7	10ECL67	Advanced Communication Lab	EC	-	3	3	25	50	75
8	10ECL68	Microprocessor Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-1

10EC665	Data Structures Using C++
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**SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION**

VII Semester

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC71	Computer Communication Networks	EC	4	-	3	25	100	125
2	10EC72	Optical Fiber Communication	EC	4	-	3	25	100	125
3	10EC73	Power Electronics	EC	4	-	3	25	100	125
4	10EC74	Embedded System Design	EC	4	-	3	25	100	125
5	10EC75x	Elective-II (Group B)	EC	4	-	3	25	100	125
6	10EC76x	Elective-III (Group C)	EC	4	-	3	25	100	125
7	10ECL77	VLSI Lab	EC	-	3	3	25	50	75
8	10ECL78	Power Electronics Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-2	
10EC751	DSP Algorithms & Architecture
Elective-3	
10EC762	Real Time Systems

SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC81	Wireless Communication	EC	4	-	3	25	100	125
2	10EC82	Digital Switching System	EC	4	-	3	25	100	125
3	10EC83x	Elective-IV (Group D)	EC	4	-	3	25	100	125
4	10EC84x	Elective-V (Group E)	EC	4	-	3	25	100	125
5	10ECP85	Project Work	EC	-	6	3	100	100	200
6	10ECS86	Seminar	EC	-	3	-	50	-	50
TOTAL				16	09	15	250	500	750

Elective-4	
10EC833	Optical Networks
Elective-5	
10EC843	GSM

ENGINEERING MATHEMATICS – III

Sub Code	:	10MAT31	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Fourier Series

Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT 2:

Fourier Transforms

Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT 3:

Partial Differential Equations (P.D.E)

Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT 4:

Applications of P.D.E

Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

UNIT 5:

Numerical Methods

Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel

iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT 6:

Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule.
(All formulae / rules without proof).

UNIT 7:

Calculus of Variations

Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT 8:

Difference Equations and Z-transforms

Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

ANALOG ELECTRONIC CIRCUITS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES32	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers.

UNIT 2:

Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization.

UNIT 3:

Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits r_c model; analysis of CE configuration using h- parameter model; Relationship between h- parameter model of CE, CC and CE configuration.

UNIT 4:

Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects.

UNIT 5:

(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections.

(b) Feedback Amplifier: Feedback concept, Feedback connections type, Practical feedback circuits. Design procedures for the feedback amplifiers.

UNIT 6:

Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. Designing of Power amplifiers.

UNIT 7:

Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only)
Simple design methods of Oscillators.

UNIT 8:

FET Amplifiers: FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks.

TEXT BOOK:

1. “**Electronic Devices and Circuit Theory**”, Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 9TH Edition.

REFERENCE BOOKS:

1. ‘**Integrated Electronics**’, Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2nd Edition, 2010
2. “**Electronic Devices and Circuits**”, David A. Bell, PHI, 4th Edition, 2004
3. “**Analog Electronics Circuits: A Simplified Approach**”, U.B. Mahadevaswamy, Pearson/Saguine, 2007.

LOGIC DESIGN
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES33	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Principles of combinational logic-1: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations.

UNIT 2:

Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables.

UNIT 3:

Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders.

UNIT 4:

Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

UNIT 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The \overline{S} \overline{R} Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

UNIT 6:

Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops

UNIT 7:

Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design.

UNIT 8:

Sequential Design - II: Construction of state Diagrams, Counter Design.

TEXT BOOKS:

1. “**Digital Logic Applications and Design**”, John M Yarbrough, Thomson Learning, 2001.
2. “**Digital Principles and Design**“, Donald D Givone, Tata McGraw Hill Edition, 2002.

REFERENCE BOOKS:

1. “**Fundamentals of logic design**”, Charles H Roth, Jr; Thomson Learning, 2004.
2. “**Logic and computer design Fundamentals**”, Mono and Kim, Pearson, Second edition, 2001.
3. “**Logic Design**”, Sudhakar Samuel, Pearson/Saguine, 2007

NETWORK ANALYSIS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES34	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT 2:

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

UNIT 3:

Network Theorems – 1: Superposition, Reciprocity and Millman’s theorems.

UNIT 4:

Network Theorems - II:

Thevenin's and Norton's theorems; Maximum Power transfer theorem

UNIT 5: Resonant Circuits: Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

UNIT 6:

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

UNIT 7:

Laplace Transformation & Applications : Solution of networks, step, ramp and impulse responses, waveform Synthesis

UNIT 8:

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets.

TEXT BOOKS:

1. “**Network Analysis**”, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. “**Networks and systems**”, Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.

REFERENCE BOOKS:

1. “**Engineering Circuit Analysis**”, Hayt, Kemmerly and DurbinTMH 7th Edition, 2010
2. “**Basic Engineering Circuit Analysis**”, J. David Irwin / R. Mark Nelms, John Wiley, 8th ed, 2006.
3. “**Fundamentals of Electric Circuits**”, Charles K Alexander and Mathew N O Sadiku, Tata McGraw-Hill, 3 ed, 2009.

ELECTRONIC INSTRUMENTATION
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10IT35	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT – 1:

Introduction

(a) Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures.

(b) Voltmeters and Multimeters Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.

UNIT – 2:

Digital Instruments

Digital Voltmeters – Introduction, DVM's based on $V - T$, $V - F$ and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time.

UNIT – 3:

Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch.

UNIT – 4:

Special Oscilloscopes

Delayed time-base oscilloscopes, Analog storage, Sampling and Digital storage oscilloscopes.

UNIT – 5:

Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer.

UNIT – 6:

Measurement of resistance, inductance and capacitance

Whetstone's bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection

UNIT – 7:

Transducers - I

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT.

UNIT – 8:

Miscellaneous Topics

(a) Transducers - II –Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple .

(b) Display devices: Digital display system, classification of display, Display devices, LEDs, LCD displays.

(c) Bolometer and RF power measurement using Bolometer

(d) Introduction to Signal conditioning.

(e) Introduction to LabView.

TEXT BOOKS:

1. **“Electronic Instrumentation”**, H. S. Kalsi, TMH, 3rd 2010
2. **“Electronic Instrumentation and Measurements”**, David A Bell, PHI / Pearson Education, 2006.

REFERENCE BOOKS:

1. **“Principles of measurement systems”**, John P. Beatley, 3rd Edition, Pearson Education, 2000
2. **“Modern electronic instrumentation and measuring techniques”**, Cooper D & A D Helfrick, PHI, 1998.
3. **Electronics & electrical measurements**, A K Sawhney, , Dhanpat Rai & sons, 9th edition.

FIELD THEORY
(Common to EC/TC/ML/EE)

Sub Code	:	10ES36	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge.

b. Electric flux density, Gauss' law and divergence: Electric flux density, Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator ∇ and divergence theorem.

UNIT 2:

a. Energy and potential : Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient , Energy density in an electrostatic field.

b. Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, capacitance and examples.

UNIT 3:

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations.

UNIT 4:

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.

UNIT 5:

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

UNIT 6:

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

UNIT 7:

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect).

UNIT 8:

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions.

TEXT BOOK:

1. “**Engineering Electromagnetics**”, William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS:

1. “**Electromagnetics with Applications**”, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999
2. “**Electromagnetic Waves And Radiating Systems,**” Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002
3. “**Field and Wave Electromagnetics**”, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

ANALOG ELECTRONICS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL37	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use the Discrete components to test the circuits. LabView can be used for the verification and testing along with the above.

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.
2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)
3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)
4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for $f_0 \leq 10$ KHz
5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range $f_0 \geq 100$ KHz.
6. Testing for the performance of BJT -Crystal Oscillator for $f_0 > 100$ KHz
- 7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection
8. Testing of Clamping circuits: positive clamping /negative clamping.
9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.
10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency

11. Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.

12. Characteristics of Series and Parallel resonant circuits.

LOGIC DESIGN LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL38	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use discrete components to test and verify the logic gates. LabView can be used for designing the gates along with the above.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3. (i) Realization of parallel adder/Subtractors using 7483 chip
(ii) BCD to Excess-3 code conversion and vice versa.
4. Realization of Binary to Gray code conversion and vice versa
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.
6. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display and b) Priority encoder.
8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).
10. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
11. Wiring and testing Ring counter/Johnson counter.
12. Wiring and testing of Sequence generator.

ENGINEERING MATHEMATICS - IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Numerical Methods

Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (All formulae without Proof).

UNIT 2:

Complex Variables

Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition. Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT 3:

Complex Integration

Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only).

UNIT 4:

Series solution of Ordinary Differential Equations and Special Functions

Series solution – Frobenius method, Series solution of Bessel’s D.E. leading to Bessel function of first kind. Equations reducible to Bessel’s D.E., Series solution of Legendre’s D.E. leading to Legendre Polynomials. Rodrigue’s formula.

UNIT 5:

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem.

UNIT 6:

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson, Normal and Exponential distributions.

UNIT 7:

Sampling, Sampling distribution, Standard error. Testing of hypothesis for means. Confidence limits for means, Student's t distribution, Chi-square distribution as a test of goodness of fit.

UNIT 8:

Concept of joint probability – Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient.

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

Text book:

1. **Higher Engineering Mathematics** by Dr. B.S. Grewal, 36th Edn. Kanna Publications.
2. **Probability** by Seymour Lipschutz (Schaum's series)

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

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MICROCONTROLLERS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES42	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

UNIT 2:

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

UNIT 3:

8051 programming: Assembler directives, Assembly language programs and Time delay calculations.

UNIT 4:

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming

UNIT 5:

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .

UNIT 6:

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

Course Aim – The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultra-low power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

UNIT 7:

Motivation for MSP430 microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design).

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

Introduction to Code Composer Studio (CCS v4). Understanding how to use CCS for Assembly, C, Assembly+C projects for MSP430 microcontrollers. Interrupt programming.

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins.

UNIT 8:

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA.

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low-power programming and Interrupt.

Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces.

TEXT BOOKS:

1. “**The 8051 Microcontroller and Embedded Systems – using assembly and C**”-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006
2. “**MSP430 Microcontroller Basics**”, John Davies, Elsevier, 2008.

REFERENCE BOOKS:

1. “**The 8051 Microcontroller Architecture, Programming & Applications**”, 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.
2. “**The 8051 Microcontroller**”, V.Udayashankar and MalikarjunaSwamy, TMH, 2009
3. **MSP430 Teaching CD-ROM**, Texas Instruments, 2008 (can be requested <http://www.uniti.in>)
4. **Microcontrollers: Architecture, Programming, Interfacing and System Design**”,Raj Kamal, “Pearson Education, 2005

CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES43	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Modeling of Systems: Introduction to Control Systems, Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical systems, Friction, Translational systems (Mechanical accelerometer, systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded),

UNIT 3:

Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. Introduction to PID Controllers(excluding design)

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion.

UNIT 5:

Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci.

UNIT 6:

Frequency domain analysis: Correlation between time and frequency response, Bode plots, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. Introduction to lead, lag and lead-lag compensating networks (excluding design).

UNIT 7:

Stability in the frequency domain: Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded).

UNIT 8:

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

TEXT BOOK :

1. J. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, Fourth edition – 2005

REFERENCE BOOKS:

1. **“Modern Control Engineering “**, K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002.
2. **“Automatic Control Systems”**, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. **“Feedback and Control System”**, Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007.

SIGNALS & SYSTEMS
(Common to EC/TC/IT/BM/ML)

Sub Code	: 10EC44	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT 2:

Time-domain representations for LTI systems – 1: Convolution, impulse response representation, Convolution Sum and Convolution Integral.

UNIT 3:

Time-domain representations for LTI systems – 2: Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT 4:

Fourier representation for signals – 1: Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties .

UNIT 5:

Fourier representation for signals – 2: Discrete and continuous Fourier transforms(derivations of transforms are excluded) and their properties.

UNIT 6:

Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling theorem and Nyquist rate.

UNIT 7:

Z-Transforms – 1: Introduction, Z – transform, properties of ROC, properties of Z – transforms, inversion of Z – transforms.

UNIT 8:

Z-transforms – 2: Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations.

TEXT BOOK

1. **Simon Haykin**, “Signals and Systems”, John Wiley India Pvt. Ltd., 2nd Edn, 2008.
2. **Michael Roberts**, “Fundamentals of Signals & Systems”, 2nd ed, Tata McGraw-Hill, 2010

REFERENCE BOOKS:

1. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, “Signals and Systems” Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
2. **H. P Hsu, R. Ranjan**, “Signals and Systems”, Scham’s outlines, TMH, 2006
3. **B. P. Lathi**, “Linear Systems and Signals”, Oxford University Press, 2005
4. **Ganesh Rao and Satish Tunga**, “Signals and Systems”, Pearson/Sanguine Technical Publishers, 2004

**FUNDAMENTALS OF HDL
(Common to EC/TC/IT/BM/ML)**

Sub Code	: 10EC45	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT 2:

Data –Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors.

UNIT 3:

Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT 4:

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT 5: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions.

Advanced HDL Descriptions: File Processing, Examples of File Processing

UNIT 6:

Mixed –Type Descriptions: Why Mixed-Type Description? VHDL User-Defined Types, VHDL Packages, Mixed-Type Description examples

UNIT 7:

Mixed –Language Descriptions: Highlights of Mixed-Language Description, How to invoke One language from the Other, Mixed-language Description Examples, Limitations of Mixed-Language Description.

UNIT 8:

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

TEXT BOOKS:

1. **HDL Programming (VHDL and Verilog)**- Nazeih M.Botros- John Wiley India Pvt. Ltd. 2008.

REFERENCE BOOKS:

1. **Fundamentals of HDL** – Cyril P.R. Pearson/Sanguin 2010.
2. **VHDL** –Douglas perry-Tata McGraw-Hill
3. **A Verilog HDL Primer**- J.Bhaskar – BS Publications
4. **Circuit Design with VHDL**-Volnei A.Pedroni-PHI

LINEAR IC's & APPLICATIONS
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10EC46	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Operational Amplifier Fundamentals: Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Op-Amps as DC Amplifiers- Biasing Op-Amps, Direct coupled -Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.

UNIT 2:

Op-Amps as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance - Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, High input impedance - Capacitor coupled Non-inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply.

UNIT 3:

Op-Amps frequency response and compensation: Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions.

UNIT 4:

OP-AMP Applications: Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, precision rectifiers, Limiting circuits.

UNIT 5:

More applications: Clamping circuits, Peak detectors, sample and hold circuits, V to I and I to V converters, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators, Wave form generator design, phase shift oscillator, Wein bridge oscillator.

UNIT 6:

Non-linear circuit applications: crossing detectors, inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Active Filters –First and second order Low pass & High pass filters.

UNIT 7:

Voltage Regulators: Introduction, Series Op-Amp regulator, IC Voltage regulators, 723 general purpose regulator, Switching regulator.

UNIT 8:

Other Linear IC applications: 555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger; PLL-operating principles, Phase detector / comparator, VCO; D/A and A/ D converters – Basic DAC Techniques, AD converters.

TEXT BOOKS:

1. “Operational Amplifiers and Linear IC’s”, David A. Bell, 2nd edition, PHI/Pearson, 2004
2. “Linear Integrated Circuits”, D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International

REFERENCE BOOKS:

1. “Opamps- Design, Applications and Trouble Shooting”, Terrell, Elsevier, 3rd ed. 2006.
2. “Operational Amplifiers”, George Clayton and Steve Winder, Elsevier 5th ed., 2008

3. “Operational Amplifiers and Linear Integrated Circuits”, Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson, 2006
4. “Design with Operational Amplifiers and Analog Integrated Circuits”, Sergio Franco, TMH, 3e, 2005

MICROCONTROLLERS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	: 10ESL47	IA Marks	: 25
Hrs/ Week	: 03	Exam Hours	: 03
Total Hrs.	: 42	Exam Marks	: 50

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430.

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

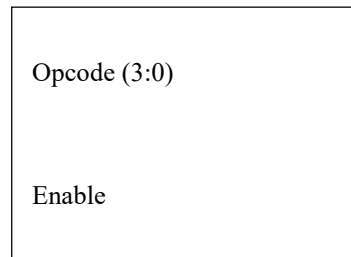
HDL LAB
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10ECL48	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/AceX/Max/Spartan/Sinfi/TK Base or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

PROGRAMMING (using VHDL /Verilog)

1. Write HDL code to realize all the logic gates
2. Write a HDL program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
2. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
3. Write a model for 32 bit ALU using the schematic diagram shown below
A (31:0) B (31:0)



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line is high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the given in example below.

OPCODE	ALU OPERATION
1.	A + B
2.	A – B
3.	A Complement
4.	A * B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

4. Develop the HDL code for the following flip-flops, SR, D, JK, T.
5. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters

INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on the given seven segment display and LCD and accepting Hex key pad input data.
2. Write HDL code to control speed, direction of DC and Stepper motor.
3. Write HDL code to accept 8 channel Analog signal, Temperature sensors and display the data on LCD panel or Seven segment display.
4. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.
5. Write HDL code to simulate Elevator operations
- 6.** Write HDL code to control external lights using relays.

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of Management - Management as a Science, Art or Profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-Early Management Approaches-Modern Management Approaches.

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

UNIT - 3

ORGANISING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees – Centralisation Vs Decentralisation of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship - Evolution of

Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI - Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

TEXT BOOKS:

1. **Principles of Management** - P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th Edition, 2010
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House.
3. **Entrepreneurship Development** - Small Business Enterprises - Poornima M Charantimath - Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development Robert Lusier – Thomson.
2. **Entrepreneurship Development** - S S Khanka - S Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education /PHI -17th Edition, 2003.

DIGITAL SIGNAL PROCESSING

Subject Code	: 10EC52	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.

UNIT - 2

Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

UNIT - 3

Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).

UNIT - 4

Radix-2 FFT algorithm for the computation of DFT and IDFT—decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform

UNIT - 5

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations.

UNIT - 6

Implementation of discrete-time systems: Structures for IIR and FIR systems- direct form I and direct form II systems, cascade, lattice and parallel realization.

UNIT - 7

FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlett and Kaiser windows, FIR filter design using frequency sampling technique.

UNIT - 8

Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

TEXT BOOK:

1. **Digital signal processing – Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. **Digital Signal Processing**, Lee Tan: Elsvier publications, 2007

ANALOG COMMUNICATION

Subject Code	: 10EC53	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

UNIT - 2

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

UNIT - 3

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves.

UNIT - 4

VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

UNIT - 5

ANGLE MODULATION (FM)-I: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

UNIT - 6

ANGLE MODULATION (FM)-II: Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

UNIT - 7

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

UNIT - 8

NOISE IN CONTINUOUS WAVE MODULATION SYSTEMS: Introduction, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM,.

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 5th Edition, John Wiley, India Pvt. Ltd, 2009.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, Oxford University Press., 4th ed, 2010,
2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. **Communication Systems: Singh and Sapre: Analog and digital** TMH 2nd , Ed 2007.

MICROWAVES AND RADAR

Subject Code	: 10EC54	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MICROWAVE TRANSMISSION LINES: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors.

UNIT - 2

MICROWAVE WAVEGUIDES AND COMPONENTS: Introduction, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators.

UNIT - 3

MICROWAVE DIODES,

Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers
Other diodes: PIN diodes, Schottky barrier diodes.

UNIT - 4

Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi port networks.

UNIT - 5

Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees.

UNIT - 6

STRIP LINES: Introduction, Microstrip lines, Parallèle strip lines, Coplanar strip lines, Shielded strip Lines.

UNIT - 7

AN INTRODUCTION TO RADAR: Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, the origins of Radar.

UNIT - 8

MTI AND PULSE DOPPLER RADAR: Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

TEXT BOOKS:

1. **Microwave Devices and circuits-** Liao / Pearson Education.
2. **Introduction to Radar systems-**Merrill I Skolnik, 3rd Ed, TMH, 2001.
3. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.

REFERENCE BOOK:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.

INFORMATION THEORY AND CODING

Subject Code	: 10EC55	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

UNIT - 2

SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

UNIT - 3

FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

UNIT - 4

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT - 5

INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

UNIT - 6

Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

UNIT - 7

RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

UNIT - 8

Convolution Codes, Time domain approach. Transform domain approa

TEXT BOOKS:

1. **Digital and analog communication systems**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. **Digital communication**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **ITC and Cryptography**, Ranjan Bose, TMH, II edition, 2007
2. **Digital Communications** - Glover and Grant; Pearson Ed. 2nd Ed 2008.
- 3.

FUNDAMENTALS OF CMOS VLSI

Subject Code	: 10EC56	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

BASIC MOS TECHNOLOGY: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.

MOS TRANSISTOR THEORY: Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

UNIT - 2

CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Tutorial exercises.

Basic Physical Design of Simple logic gates.

UNIT - 3

CMOS LOGIC STRUCTURES: CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL).

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

SCALING OF MOS CIRCUITS: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

UNIT - 5

CMOS SUBSYSTEM DESIGN: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations.

Clocking Strategies

UNIT - 6

CMOS SUBSYSTEM DESIGN PROCESSES: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

UNIT - 7

MEMORY, REGISTERS AND CLOCK: Timing considerations. Memory elements. Memory cell arrays.

UNIT - 8

TESTABILITY: Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability.

TEXT BOOKS:

1. **CMOS VLSI Design – A Circuits and Systems Perspective. 3rd Edition.** N.H. Weste and David Harris. Addison-Wesley, 2005. (Refer to <http://www.cmosvlsi.com>)
2. **Principles of CMOS VLSI Design: A Systems Perspective,** Neil H. E. Weste, K. Eshragian, and ??? 3rd edition, Pearson Education (Asia) Pvt. Ltd., 200?. (Shift to the latest edition.)
3. **Basic VLSI Design -** Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994), 2005.

REFERENCE BOOKS:

1. R. Jacob Baker. CMOS Circuit Design, Layout and Simulation. John Wiley India Pvt. Ltd, 2008
2. **Fundamentals of Semiconductor Devices,** M. K. Achuthan and K. N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. **CMOS Digital Integrated Circuits: Analysis and Design,** Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
4. **Analysis and Design of Digital Integrated Circuits -** D.A Hodges, H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

DIGITAL SIGNAL PROCESSING LABORATORY

Subject Code	: 10ECL57	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

A LIST OF EXPERIMENTS USING MATLAB / SCILAB / OCTAVE / WAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system

REFERENCE BOOKS:

1. **Digital signal processing using MATLAB** - Sanjeet Mitra, TMH, 2001
2. **Digital signal processing using MATLAB** - J. G. Proakis & Ingale, MGH, 2000
3. **Digital Signal Processors**, B. Venkataramani and Bhaskar, TMH, 2002

ANALOG COMMUNICATION LAB + LIC LAB

Subject Code	: 10ECL58	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

**EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW
- 2009 CAN BE USED FOR VERIFICATION AND TESTING.**

1. Second order active LPF and HPF
2. Second order active BPF and BE
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
 - a. Astable multivibrator for given frequency and duty cycle
 - b. Monostable multivibrator for given pulse width W
7. IF amplifier design
8. Amplitude modulation using transistor/FET (Generation and detection)
9. Pulse amplitude modulation and detection
10. PWM and PPM
11. Frequency modulation using 8038/2206
12. Precision rectifiers – both Full Wave and Half Wave.

VI SEMESTER

DIGITAL COMMUNICATION

Subject Code	: 10EC61	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery.

UNIT - 2

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, robust quantization.

UNIT - 3

DPCM, DM, applications. Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals.

UNIT - 4

ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

UNIT - 5

DIGITAL MODULATION TECHNIQUES: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques.

UNIT - 6

Detection and estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

UNIT - 7

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

UNIT - 8

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency

hop spread spectrum, applications.

TEXT BOOK:

1. **Digital communications**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **Digital and Analog communication systems**, Simon Haykin, John Wiley India Pvt. Ltd, 2008
2. **An introduction to Analog and Digital Communication**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 2008.
3. **Digital communications** - Bernard Sklar: Pearson education 2007

MICROPROCESSOR

Subject Code	: 10EC62	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing, The 8086

UNIT - 2

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators

UNIT - 3

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display

UNIT - 4

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples

UNIT - 5

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor

UNIT - 6

8086 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples

UNIT - 7

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the universal serial bus (USB)

UNIT - 8

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.

TEXT BOOKS:

1. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and G. A. Gibson, 2E PHI -2003
2. **The Intel Microprocessor, Architecture, Programming and Interfacing**-Barry B. Brey, 6e, Pearson Education / PHI, 2003

REFERENCE BOOKS:

1. **Microprocessor and Interfacing- Programming & Hardware**, Douglas hall, 2nd, TMH, 2006.
2. **Advanced Microprocessors and Peripherals** - A.K. Ray and K.M. Bhurchandi, TMH, 2nd, 2006.
3. **8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware & Applications** - Triebel and Avtar Singh, 4e, Pearson Education, 2003

MICROELECTRONICS CIRCUITS

Subject Code : **10EC63**

No. of Lecture Hrs/Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

UNIT – 1

MOSFETS: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation modes, single stage MOS amplifiers. MOSFET internal capacitances and high frequency modes, Frequency response of CS amplifiers, CMOS digital logic inverter, detection type MOSFET.

UNIT -2

Single Stage IC Amplifier: IC Design philosophy, Comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response.

UNIT – 3

Single Stage IC amplifiers (continued): CS and CF amplifiers with loads, high frequency response of CS and CF amplifiers, CG and CB amplifiers with active loads, high frequency response of CG and CB amplifiers, Cascade amplifiers. CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance. SPICE examples.

UNIT – 4

Differences and Multistage Amplifiers: The MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers. Multistage amplifier. SPICE examples.

UNIT – 5

Feedback. General Feedback structure. Properties of negative feedback. Four basic feedback topologies. Series-Shunt feedback. Determining the loop gain. Stability problem. Effect of feedback on amplifier poles. Stability study using Bode plots. Frequency compensation. SPICE examples.

UNIT - 6

Operational Amplifiers: The two stage CMOS Op-amp, folded cascade CMOS op-amp, 741 op-amp circuit, DC analysis of the 741, small signal analysis of 741, gain, frequency response and slew rate of 741. Data Converters. A-D and D-A converters.

UNIT – 7 & 8

Digital CMOS circuits. Overview. Design and performance analysis of CMOS inverter. Logic Gate Circuits. Pass-transistor logic. Dynamic Logic Circuits. SPICE examples.

Text Book:

1. “**Microelectronic Circuits**”, Adel Sedra and K.C. Smith, 5th Edition, Oxford University Press, Interantional Version, 2009.

Reference Book:

1. “**Fundamentals of Microelectronics**”, Behzad Razavi, John Wiley India Pvt. Ltd, 2008.
2. “**Microelectronics – Analysis and Design**”, Sundaram Natarajan, Tata McGraw-Hill, 2007

ANTENNAS AND PROPAGATION

Subject Code	: 10EC64	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna filed zones.

UNIT - 2

POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources. Endfire array and Broadside array.

UNIT - 3

ELECTRIC DIPOLES AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole(no derivation of field components), radiation resistance of short dipole, radiation resistances of $\lambda/2$ Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

UNIT - 4 & 5

LOOP, SLOT, PATCH AND HORN ANTENNA: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Babinet’s principle and complementary antennas,

impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas.

UNIT - 6

ANTENNA TYPES: Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna, high-resolution data, intelligent antennas, antenna for remote sensing.

UNIT - 7 & 8

RADIO WAVE PROPAGATION: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.

TROPOSPHERE WAVE PROPAGATION: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

TEXT BOOKS:

1. **Antennas and Wave Propagation**, John D. Krauss, 4th Edn, McGraw-Hill International edition, 2010.
2. **Antennas and Wave Propagation** - Harish and Sachidananda: Oxford Press 2007

REFERENCE BOOKS:

1. **Antenna Theory Analysis and Design** - C A Balanis, 3rd Edn, John Wiley India Pvt. Ltd, 2008
2. **Antennas and Propagation for Wireless Communication Systems** - Sineon R Saunders, John Wiley, 2003.
3. **Antennas and wave propagation** - G S N Raju: Pearson Education 2005

OPERATING SYSTEMS

Subject Code	: 10EC65	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS:

Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating

systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

UNIT - 2

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

UNIT - 3

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris.

UNIT - 4

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

UNIT - 5

VIRTUAL MEMORY: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

UNIT - 6

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

UNIT - 7

SCHEDULING: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX.

UNIT - 8

MESSAGE PASSING: Implementing message passing, Mailboxes, Inter process communication in UNIX.

TEXT BOOK:

1. **“Operating Systems - A Concept based Approach”**, D. M. Dhamdhare, TMH, 3rd Ed, 2010.

REFERENCE BOOK:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.
3. **Design of Operating Systems**, Tennambhaum, TMH, 2001.

ADVANCED COMMUNICATION LAB

Subject Code	: 10ECL67	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

LIST OF EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW – 2009 can be used for verification and testing.

1. TDM of two band limited signals.
2. ASK and FSK generation and detection
3. PSK generation and detection
4. DPSK generation and detection
5. QPSK generation and detection
6. PCM generation and detection using a CODEC Chip
7. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture
8. Analog and Digital (with TDM) communication link using optical fiber.
9. Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench
10. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).
11. Determination of coupling and isolation characteristics of a stripline (or microstrip) directional coupler
12. (a) Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate.

(b) Measurement of power division and isolation characteristics of a microstrip 3 dB power divider.

MICROPROCESSOR LAB

Subject Code	: 10ECL68	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

I) Programs involving

- 1) Data transfer instructions like:
 - i] Byte and word data transfer in different addressing modes.
 - ii] Block move (with and without overlap)
 - iii] Block interchange

- 2) Arithmetic & logical operations like:
 - i] Addition and Subtraction of multi precision nos.
 - ii] Multiplication and Division of signed and unsigned Hexadecimal nos.
 - iii] ASCII adjustment instructions
 - iv] Code conversions
 - v] Arithmetic programs to find square cube, LCM, GCD, factorial

- 3) Bit manipulation instructions like checking:
 - i] Whether given data is positive or negative
 - ii] Whether given data is odd or even
 - iii] Logical 1's and 0's in a given data
 - iv] 2 out 5 code
 - v] Bit wise and nibble wise palindrome

- 4) Branch/Loop instructions like:
 - i] Arrays: addition/subtraction of N nos.
Finding largest and smallest nos.
Ascending and descending order
 - ii] Near and Far Conditional and Unconditional jumps,
Calls and Returns

- 5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.

- 6) Programs involving Software interrupts
Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console
- II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card
 - a) Matrix keyboard interfacing
 - b) Seven segment display interface
 - c) Logical controller interface
 - d) Stepper motor interface
- III) Other Interfacing Programs
 - a) Interfacing a printer to an X86 microcomputer
 - b) PC to PC Communication

ELECTIVE – GROUP A

ANALOG AND MIXED MODE VLSI DESIGN

Subject Code	: 10EC661	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

(Text Book 1)

UNIT 1

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT 2

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT 3

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

(Text Book 2)

UNIT 4:

Data Converter SNR: Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating

UNIT - 2

Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

UNIT – 3&4

SYNTHESIS FOR LOW POWER: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

UNIT – 5&6

DESIGN AND TEST OF LOW-VOLTAGE CMOS CIRCUITS:

Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V_{gs} , steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

UNIT - 7

LOW ENERGY COMPUTING: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

UNIT - 8

SOFTWARE DESIGN FOR LOW POWER: Introduction, sources of power dissipation, power estimation and optimization.

TEXT BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy and Sharat C Prasad, John Wiley Pvt. Ltd, 2008.

DATA STRUCTURE USING C++

Subject Code : **10EC665**

IA Marks : 25

No. of Lecture Hrs/Week : 04

Exam Hours : 03

UNIT - 1

INTRODUCTION: Functions and parameters, Dynamic memory allocation classis, Testing and debugging. Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing simulating pointers.

UNIT - 2

ARRAYS AND MATRICES: Arrays, Matrices, Special matrices spare matrices.

UNIT - 3

STACKS: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications.

UNIT - 4

Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked Linked representation, Applications.

UNIT - 5

SKIP LISTS AND HASHING: Dictionaries, Linear representation, Skip list presentation, Hash table representation.

UNIT - 6

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.

UNIT - 7

PRIORITY QUEUES: Linear lists, Heaps, Leftist trees.

UNIT-8

Search Trees: Binary search trees, B-trees, Applications.

TEXT BOOK:

1. **Data structures, Algorithms, and applications in C++** - Sartaj Sahni, McGraw Hill.2000.

REFERENCE BOOKS:

1. **Object Oriented Programming in C++** - Balaguruswamy. TMH, 1995.
2. **Programming in C++** - Balaguruswamy. TMH, 4th, 2010 .

DIGITAL SYSTEMS DESIGN USING VHDL

Subject Code	: 10EC666	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

Resolution and sampling frequency – Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi channel analog inputs. Concept of universal DAQ card – Use of timer-counter and analog outputs on the universal DAQ card.

UNIT 3

Cluster of Instruments in System: Interfacing of external instruments to a PC – RS 232C, RS – 422, RS 485 and USB standards – IEEE 488 standard – ISO –OSI model for series bus – introduction to bus protocols of MOD bus and CAN bus.

UNIT 4

Graphical Programming Environment in VI: Concepts of graphical programming – Lab-view software – Concept of VIs and sub VIs – Display types – Digital – Analog – Chart – Oscilloscope types – Loops – Case and sequence structures – Types of data – Arrays – Formulate nodes – Local and Global variables – String and file I/O.

UNIT 5

Analysis Tools and Simple Application in VI: Fourier transform – Power spectrum – Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – PID controller – CRO emulation – Simulation of a simple second order system – Generation of HTML page.

Reference Books:

1. S. Gupta and J P Gupta, "PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994
2. Peter W Gofton , "Understanding Serial Communication", Sybes International, 2000
3. Robert H. Bishop, "Learning with Lab-View" Prentice Hall, 2009
4. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
5. Ernest O. Doebelin and Dhanesh N Manik, " Measurement Systems – Application and Design", 5th Edn, TMH, 2007.

VII SEMESTER

COMPUTER COMMUNICATION NETWORKS

Subject Code	: 10EC71	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC.

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation.

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Backbone Networks, Virtual LANs

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: 10EC72	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point-to-point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT BOOKS:

1. "**Optical Fiber Communication**", Gerd Keiser, 4th Ed., MGH, 2008.
2. "**Optical Fiber Communications**", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: 10EC73	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base drive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1ϕ fully controlled converters, Dual converters, 1ϕ semi converters (all converters with R & RL load).

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with resistive loads and Inductive loads, numerical problems.

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification, Switch mode regulators – buck, boost and buck – boost regulators.

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1ϕ bridge inverter, voltage control of 1ϕ invertors, current source invertors, Variable DC link inverter.

TEXT BOOKS:

1. **“Power Electronics”** - M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
2. **“Power Electronics”** - M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

1. **“Power Electronics, Essentials and Applications”, L Umanand,** John Wiley India Pvt. Ltd, 2009.
2. **“Power Electronics”** , Daniel W. Hart, McGraw Hill, 2010.
3. **“Power Electronics”**, V Nattarasu and R.S. Anandamurhty, Pearson/Sanguine Pub. 2006.

EMBEDDED SYSTEM DESIGN

Subject Code	: 10EC74	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.

UNIT 2:

The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor
The Hardware Side: Storage Elements and Finite-State Machines (2 hour)
The concepts of State and Time, The State Diagram, Finite State Machines-A Theoretical Model.

UNIT 3:

Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation.

UNIT 4:

Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The

Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project.

UNIT 5 & 6:

Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited

UNIT 7 & 8:

Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance

Text Book:

1. **Embedded Systems – A contemporary Design**
Tool, James K. Peckol, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. **Embedded Systems: Architecture and Programming**, Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Programming for Embedded Systems**, Dreamtech Software Team, John Wiley India Pvt. Ltd, 2008

VLSI LAB

Subject Code : **10ECL77**
No. of Practical Hrs/Week : 03
Total no. of Practical Hrs. : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

(Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used)

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesize** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

- i. An inverter
- ii. A Buffer
- iii. Transmission Gate
- iv. Basic/universal gates
- v. Flip flop -RS, D, JK, MS, T
- vi. Serial & Parallel adder
- vii. 4-bit counter [Synchronous and Asynchronous counter]
- viii. Successive approximation register [SAR]

** An appropriate constraint should be given*

PART - B

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:

- a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis

b. **Draw the Layout** and verify the DRC, ERC

c. Check for LVS

d. Extract RC and back annotate the same and verify the Design

e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:

- a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis

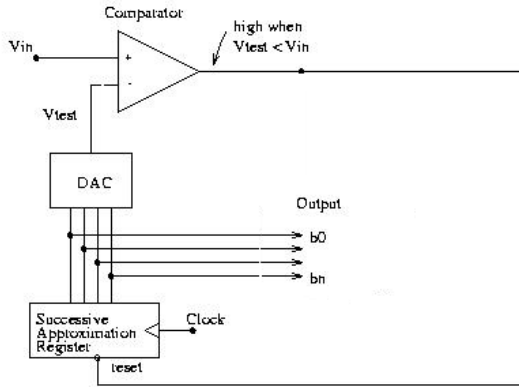
- iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier
 - ii) Common source and Common Drain amplifier

- 3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



- * Appropriate specification should be given.
- ** Applicable Library should be added & information should be given to the Designer.
- *** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: 10ECL78	IA Marks	: 25
No. of Practical Hrs/Week:	: 03	Exam Hours	: 03
Total no. of Practical Hrs. :	: 42	Exam Marks	: 50

Any five converter circuits experiment from the below list **must be** simulated using the **spice-simulator**.

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT.
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using i) LC circuit ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of a separately excited DC motor.
11. Speed control of universal motor.

12. Speed control of stepper motor.

13. Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: 10EC751	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control.

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOK:

1. **“Digital Signal Processing”**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Iffachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **“Digital Signal Processors”**, B Venkataramani and M Bhaskar TMH, 2nd, 2010
3. **“Architectures for Digital Signal Processing”**, Peter Pirsch John Wiley, 2008

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	: 10MS752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 10
			0

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

Multiple Inheritances, public, private & protected inheritance, Class scope under Inheritance.

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

REAL-TIME SYSTEMS

Subject Code	: 10EC762	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hatley and Pirbhai Method.

TEXT BOOKS:

1. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: 10EC81	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2nd, 2009.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, “**Wireles and Mobile Network concepts and protocols**”, John Wiley India Pvt. Ltd, 1st edition, 2010.
5. “**Wireless Communication – Principles & Practice**”, T.S. Rappaport, PHI 2001.

DIGITAL SWITCHING SYSTEMS

Subject Code	: 10EC82	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis.

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis.

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood: Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India India Pvt. Ltd, 3rd Ed, 2008.

ELECTIVE –4 (GROUP D)

DISTRIBUTED SYSTEM

Subject Code	: 10EC831	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Client-server communication, Group communication.

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

UNIT - 2

SYMMETRIC CIPHERS: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

UNIT - 3

Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions.

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard.

UNIT - 5

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.

UNIT - 6

Intruders, Intrusion Detection, Password Management.

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures.

UNIT - 8

Firewalls Design Principles, Trusted Systems.

TEXT BOOK:

1. **Cryptography and Network Security**, William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

OPTICAL NETWORKS

Subject Code

: **10EC833**

IA Marks

: 25

No. of Lecture Hrs/Week : 04
Total no. of Lecture Hrs. : 52

Exam Hours : 03
Exam Marks : 100

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons.

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers.

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters.

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks.

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations.

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment

considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

TEXT BOOK:

1. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

1. **Optical Communication Networks:** Biswajit Mukherjee: TMG 1998.
2. **Optical Networks,** Ulysees Black: Pearson education 2007.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: 10EC834	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE:

Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV.

UNIT - 5

GSM

Subject Code	: 10EC843	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers.

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna.

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. **MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services.

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

TEXT BOOK:

1. **“Principles of Applications of GSM”**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication**, [Friedhelm Hillebrand](#), John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: 10EC844	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols.

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT - 6

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a transport layer protocol

for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning.

UNIT - 8

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

TEXT BOOK:

1. “Ad hoc wireless Networks”, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. “Ad hoc wireless Networks”, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. “Ad hoc wireless Networking”, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: 10EC845	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens , sampling and quantization, image enhancement, image restoration.

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring.

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations.

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
III SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 31	Engg. Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Ckts	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10IT– 35	Electronic Instrumentation	@	04		03	25	100	125
10ES – 36	Field Theory	@	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
IV SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teach Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 41	Engg. Mathematics – IV	Mat	04		03	25	100	125
10ES- 42	Microcontrollers	@	04		03	25	100	125
10ES – 43	Control Systems	@	04		03	25	100	125
10EC – 44	Signals & Systems	@	04		03	25	100	125
10EC– 45	Fundamentals of HDL	@	04		03	25	100	125
10EC – 46	Linear ICs & Applications	@	04		03	25	100	125
10ESL – 47	Microcontrollers Lab	@		03	03	25	50	75
10ECL – 48	HDL Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. **ES (for theory) & ECL (for Lab)** in the subject code indicates that the subject is common to electrical and electronics stream consisting of **EE/EC/IT/TC/ML/BM branches** of engineering.

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

V SEMESTER

COMMON TO EC/TE

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	EC	4	-	3	25	100	125
02	10EC52	Digital Signal Processing	EC	4	-	3	25	100	125
03	10EC53	Analog Communication	EC	4	-	3	25	100	125
04	10EC54	Microwaves and Radar	EC	4	-	3	25	100	125
05	10EC55	Information Theory and Coding	EC	4	-	3	25	100	125
06	10EC56	Fundamentals of CMOS VLSI	EC	4	-	3	25	100	125
07	10ECL57	DSP Lab	EC	-	3	3	25	50	75
08	10ECL58	Analog Communication Lab + LIC Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

1

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC61	Digital Communication	EC	4	-	3	25	100	125
2	10EC62	Microprocessors	EC	4	-	3	25	100	125
3	10EC63	Microelectronics Circuits	EC	4	-	3	25	100	125
4	10EC64	Antennas and Propagation	EC	4	-	3	25	100	125
5	10EC65	Operating Systems	EC	4	-	3	25	100	125
6	10EC66x	Elective-I (Group A)	EC	4	-	3	25	100	125
7	10ECL67	Advanced Communication Lab	EC	-	3	3	25	50	75
8	10ECL68	Microprocessor Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-1

10EC665	Data Structures Using C++
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**SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION**

VII Semester

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC71	Computer Communication Networks	EC	4	-	3	25	100	125
2	10EC72	Optical Fiber Communication	EC	4	-	3	25	100	125
3	10EC73	Power Electronics	EC	4	-	3	25	100	125
4	10EC74	Embedded System Design	EC	4	-	3	25	100	125
5	10EC75x	Elective-II (Group B)	EC	4	-	3	25	100	125
6	10EC76x	Elective-III (Group C)	EC	4	-	3	25	100	125
7	10ECL77	VLSI Lab	EC	-	3	3	25	50	75
8	10ECL78	Power Electronics Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-2	
10EC751	DSP Algorithms & Architecture
Elective-3	
10EC762	Real Time Systems

SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC81	Wireless Communication	EC	4	-	3	25	100	125
2	10EC82	Digital Switching System	EC	4	-	3	25	100	125
3	10EC83x	Elective-IV (Group D)	EC	4	-	3	25	100	125
4	10EC84x	Elective-V (Group E)	EC	4	-	3	25	100	125
5	10ECP85	Project Work	EC	-	6	3	100	100	200
6	10ECS86	Seminar	EC	-	3	-	50	-	50
TOTAL				16	09	15	250	500	750

Elective-4	
10EC833	Optical Networks
Elective-5	
10EC843	GSM

ENGINEERING MATHEMATICS – III

Sub Code	:	10MAT31	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Fourier Series

Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT 2:

Fourier Transforms

Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT 3:

Partial Differential Equations (P.D.E)

Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT 4:

Applications of P.D.E

Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

UNIT 5:

Numerical Methods

Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel

iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT 6:

Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule.
(All formulae / rules without proof).

UNIT 7:

Calculus of Variations

Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT 8:

Difference Equations and Z-transforms

Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

**ANALOG ELECTRONIC CIRCUITS
(Common to EC/TC/EE/IT/BM/ML)**

Sub Code	:	10ES32	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers.

UNIT 2:

Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization.

UNIT 3:

Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits r_c model; analysis of CE configuration using h- parameter model; Relationship between h- parameter model of CE, CC and CE configuration.

UNIT 4:

Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects.

UNIT 5:

(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections.

(b) Feedback Amplifier: Feedback concept, Feedback connections type, Practical feedback circuits. Design procedures for the feedback amplifiers.

UNIT 6:

Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. Designing of Power amplifiers.

UNIT 7:

Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only)
Simple design methods of Oscillators.

UNIT 8:

FET Amplifiers: FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks.

TEXT BOOK:

1. “**Electronic Devices and Circuit Theory**”, Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 9TH Edition.

REFERENCE BOOKS:

1. ‘**Integrated Electronics**’, Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2nd Edition, 2010
2. “**Electronic Devices and Circuits**”, David A. Bell, PHI, 4th Edition, 2004
3. “**Analog Electronics Circuits: A Simplified Approach**”, U.B. Mahadevaswamy, Pearson/Saguine, 2007.

LOGIC DESIGN
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES33	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Principles of combinational logic-1: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations.

UNIT 2:

Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables.

UNIT 3:

Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders.

UNIT 4:

Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

UNIT 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The \overline{S} \overline{R} Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

UNIT 6:

Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops

UNIT 7:

Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design.

UNIT 8:

Sequential Design - II: Construction of state Diagrams, Counter Design.

TEXT BOOKS:

1. “**Digital Logic Applications and Design**”, John M Yarbrough, Thomson Learning, 2001.
2. “**Digital Principles and Design**“, Donald D Givone, Tata McGraw Hill Edition, 2002.

REFERENCE BOOKS:

1. “**Fundamentals of logic design**”, Charles H Roth, Jr; Thomson Learning, 2004.
2. “**Logic and computer design Fundamentals**”, Mono and Kim, Pearson, Second edition, 2001.
3. “**Logic Design**”, Sudhakar Samuel, Pearson/Saguine, 2007

NETWORK ANALYSIS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES34	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT 2:

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

UNIT 3:

Network Theorems – 1: Superposition, Reciprocity and Millman’s theorems.

UNIT 4:

Network Theorems - II:

Thevenin's and Norton's theorems; Maximum Power transfer theorem

UNIT 5: Resonant Circuits: Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

UNIT 6:

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

UNIT 7:

Laplace Transformation & Applications : Solution of networks, step, ramp and impulse responses, waveform Synthesis

UNIT 8:

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets.

TEXT BOOKS:

1. “**Network Analysis**”, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. “**Networks and systems**”, Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.

REFERENCE BOOKS:

1. “**Engineering Circuit Analysis**”, Hayt, Kemmerly and DurbinTMH 7th Edition, 2010
2. “**Basic Engineering Circuit Analysis**”, J. David Irwin / R. Mark Nelms, John Wiley, 8th ed, 2006.
3. “**Fundamentals of Electric Circuits**”, Charles K Alexander and Mathew N O Sadiku, Tata McGraw-Hill, 3 ed, 2009.

ELECTRONIC INSTRUMENTATION
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10IT35	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT – 1:

Introduction

(a) Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures.

(b) Voltmeters and Multimeters Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.

UNIT – 2:

Digital Instruments

Digital Voltmeters – Introduction, DVM's based on $V - T$, $V - F$ and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time.

UNIT – 3:

Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch.

UNIT – 4:

Special Oscilloscopes

Delayed time-base oscilloscopes, Analog storage, Sampling and Digital storage oscilloscopes.

UNIT – 5:

Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer.

UNIT – 6:

Measurement of resistance, inductance and capacitance

Whetstone's bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection

UNIT – 7:

Transducers - I

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT.

UNIT – 8:

Miscellaneous Topics

(a) Transducers - II –Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple .

(b) Display devices: Digital display system, classification of display, Display devices, LEDs, LCD displays.

(c) Bolometer and RF power measurement using Bolometer

(d) Introduction to Signal conditioning.

(e) Introduction to LabView.

TEXT BOOKS:

1. **“Electronic Instrumentation”**, H. S. Kalsi, TMH, 3rd 2010
2. **“Electronic Instrumentation and Measurements”**, David A Bell, PHI / Pearson Education, 2006.

REFERENCE BOOKS:

1. **“Principles of measurement systems”**, John P. Beatley, 3rd Edition, Pearson Education, 2000
2. **“Modern electronic instrumentation and measuring techniques”**, Cooper D & A D Helfrick, PHI, 1998.
3. **Electronics & electrical measurements**, A K Sawhney, , Dhanpat Rai & sons, 9th edition.

FIELD THEORY
(Common to EC/TC/ML/EE)

Sub Code	:	10ES36	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge.

b. Electric flux density, Gauss' law and divergence: Electric flux density, Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator ∇ and divergence theorem.

UNIT 2:

a. Energy and potential : Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient , Energy density in an electrostatic field.

b. Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, capacitance and examples.

UNIT 3:

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations.

UNIT 4:

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.

UNIT 5:

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

UNIT 6:

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

UNIT 7:

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect).

UNIT 8:

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions.

TEXT BOOK:

1. **“Engineering Electromagnetics”**, William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS:

1. **“Electromagnetics with Applications”**, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999
2. **“Electromagnetic Waves And Radiating Systems,”** Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002
3. **“Field and Wave Electromagnetics”**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

ANALOG ELECTRONICS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL37	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use the Discrete components to test the circuits. LabView can be used for the verification and testing along with the above.

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.
2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)
3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)
4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for $f_0 \leq 10$ KHz
5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range $f_0 \geq 100$ KHz.
6. Testing for the performance of BJT -Crystal Oscillator for $f_0 > 100$ KHz
- 7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection
8. Testing of Clamping circuits: positive clamping /negative clamping.
9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.
10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency

11. Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.

12. Characteristics of Series and Parallel resonant circuits.

LOGIC DESIGN LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL38	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use discrete components to test and verify the logic gates. LabView can be used for designing the gates along with the above.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3. (i) Realization of parallel adder/Subtractors using 7483 chip
(ii) BCD to Excess-3 code conversion and vice versa.
4. Realization of Binary to Gray code conversion and vice versa
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.
6. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display and b) Priority encoder.
8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).
10. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
11. Wiring and testing Ring counter/Johnson counter.
12. Wiring and testing of Sequence generator.

ENGINEERING MATHEMATICS - IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Numerical Methods

Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (All formulae without Proof).

UNIT 2:

Complex Variables

Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition. Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT 3:

Complex Integration

Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only).

UNIT 4:

Series solution of Ordinary Differential Equations and Special Functions

Series solution – Frobenius method, Series solution of Bessel’s D.E. leading to Bessel function of first kind. Equations reducible to Bessel’s D.E., Series solution of Legendre’s D.E. leading to Legendre Polynomials. Rodrigue’s formula.

UNIT 5:

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem.

UNIT 6:

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson, Normal and Exponential distributions.

UNIT 7:

Sampling, Sampling distribution, Standard error. Testing of hypothesis for means. Confidence limits for means, Student's t distribution, Chi-square distribution as a test of goodness of fit.

UNIT 8:

Concept of joint probability – Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient.

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

Text book:

1. **Higher Engineering Mathematics** by Dr. B.S. Grewal, 36th Edn. Kanna Publications.
2. **Probability** by Seymour Lipschutz (Schaum's series)

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

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MICROCONTROLLERS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES42	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

UNIT 2:

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

UNIT 3:

8051 programming: Assembler directives, Assembly language programs and Time delay calculations.

UNIT 4:

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming

UNIT 5:

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .

UNIT 6:

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

Course Aim – The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultra-low power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

UNIT 7:

Motivation for MSP430 microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design).

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

Introduction to Code Composer Studio (CCS v4). Understanding how to use CCS for Assembly, C, Assembly+C projects for MSP430 microcontrollers. Interrupt programming.

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins.

UNIT 8:

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA.

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low-power programming and Interrupt.

Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces.

TEXT BOOKS:

1. “**The 8051 Microcontroller and Embedded Systems – using assembly and C**”-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006
2. “**MSP430 Microcontroller Basics**”, John Davies, Elsevier, 2008.

REFERENCE BOOKS:

1. “**The 8051 Microcontroller Architecture, Programming & Applications**”, 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.
2. “**The 8051 Microcontroller**”, V.Udayashankar and MalikarjunaSwamy, TMH, 2009
3. **MSP430 Teaching CD-ROM**, Texas Instruments, 2008 (can be requested <http://www.uniti.in>)
4. **Microcontrollers: Architecture, Programming, Interfacing and System Design**”,Raj Kamal, “Pearson Education, 2005

CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES43	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Modeling of Systems: Introduction to Control Systems, Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical systems, Friction, Translational systems (Mechanical accelerometer, systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded),

UNIT 3:

Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. Introduction to PID Controllers(excluding design)

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion.

UNIT 5:

Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci.

UNIT 6:

Frequency domain analysis: Correlation between time and frequency response, Bode plots, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. Introduction to lead, lag and lead-lag compensating networks (excluding design).

UNIT 7:

Stability in the frequency domain: Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded).

UNIT 8:

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

TEXT BOOK :

1. J. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, Fourth edition – 2005

REFERENCE BOOKS:

1. **“Modern Control Engineering “**, K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002.
2. **“Automatic Control Systems”**, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. **“Feedback and Control System”**, Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007.

SIGNALS & SYSTEMS
(Common to EC/TC/IT/BM/ML)

Sub Code	: 10EC44	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT 2:

Time-domain representations for LTI systems – 1: Convolution, impulse response representation, Convolution Sum and Convolution Integral.

UNIT 3:

Time-domain representations for LTI systems – 2: Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT 4:

Fourier representation for signals – 1: Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties .

UNIT 5:

Fourier representation for signals – 2: Discrete and continuous Fourier transforms(derivations of transforms are excluded) and their properties.

UNIT 6:

Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling theorem and Nyquist rate.

UNIT 7:

Z-Transforms – 1: Introduction, Z – transform, properties of ROC, properties of Z – transforms, inversion of Z – transforms.

UNIT 8:

Z-transforms – 2: Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations.

TEXT BOOK

1. **Simon Haykin**, “Signals and Systems”, John Wiley India Pvt. Ltd., 2nd Edn, 2008.
2. **Michael Roberts**, “Fundamentals of Signals & Systems”, 2nd ed, Tata McGraw-Hill, 2010

REFERENCE BOOKS:

1. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, “Signals and Systems” Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
2. **H. P Hsu, R. Ranjan**, “Signals and Systems”, Scham’s outlines, TMH, 2006
3. **B. P. Lathi**, “Linear Systems and Signals”, Oxford University Press, 2005
4. **Ganesh Rao and Satish Tunga**, “Signals and Systems”, Pearson/Sanguine Technical Publishers, 2004

**FUNDAMENTALS OF HDL
(Common to EC/TC/IT/BM/ML)**

Sub Code	: 10EC45	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT 2:

Data –Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors.

UNIT 3:

Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT 4:

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT 5: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions.

Advanced HDL Descriptions: File Processing, Examples of File Processing

UNIT 6:

Mixed –Type Descriptions: Why Mixed-Type Description? VHDL User-Defined Types, VHDL Packages, Mixed-Type Description examples

UNIT 7:

Mixed –Language Descriptions: Highlights of Mixed-Language Description, How to invoke One language from the Other, Mixed-language Description Examples, Limitations of Mixed-Language Description.

UNIT 8:

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

TEXT BOOKS:

1. **HDL Programming (VHDL and Verilog)**- Nazeih M.Botros- John Wiley India Pvt. Ltd. 2008.

REFERENCE BOOKS:

1. **Fundamentals of HDL** – Cyril P.R. Pearson/Sanguin 2010.
2. **VHDL** –Douglas perry-Tata McGraw-Hill
3. **A Verilog HDL Primer**- J.Bhaskar – BS Publications
4. **Circuit Design with VHDL**-Volnei A.Pedroni-PHI

LINEAR IC's & APPLICATIONS
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10EC46	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Operational Amplifier Fundamentals: Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Op-Amps as DC Amplifiers- Biasing Op-Amps, Direct coupled -Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.

UNIT 2:

Op-Amps as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance - Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, High input impedance - Capacitor coupled Non-inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply.

UNIT 3:

Op-Amps frequency response and compensation: Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions.

UNIT 4:

OP-AMP Applications: Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, precision rectifiers, Limiting circuits.

UNIT 5:

More applications: Clamping circuits, Peak detectors, sample and hold circuits, V to I and I to V converters, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators, Wave form generator design, phase shift oscillator, Wein bridge oscillator.

UNIT 6:

Non-linear circuit applications: crossing detectors, inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Active Filters –First and second order Low pass & High pass filters.

UNIT 7:

Voltage Regulators: Introduction, Series Op-Amp regulator, IC Voltage regulators, 723 general purpose regulator, Switching regulator.

UNIT 8:

Other Linear IC applications: 555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger; PLL-operating principles, Phase detector / comparator, VCO; D/A and A/ D converters – Basic DAC Techniques, AD converters.

TEXT BOOKS:

1. “Operational Amplifiers and Linear IC’s”, David A. Bell, 2nd edition, PHI/Pearson, 2004
2. “Linear Integrated Circuits”, D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International

REFERENCE BOOKS:

1. “Opamps- Design, Applications and Trouble Shooting”, Terrell, Elsevier, 3rd ed. 2006.
2. “Operational Amplifiers”, George Clayton and Steve Winder, Elsevier 5th ed., 2008

3. “Operational Amplifiers and Linear Integrated Circuits”, Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson, 2006
4. “Design with Operational Amplifiers and Analog Integrated Circuits”, Sergio Franco, TMH, 3e, 2005

MICROCONTROLLERS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	: 10ESL47	IA Marks	: 25
Hrs/ Week	: 03	Exam Hours	: 03
Total Hrs.	: 42	Exam Marks	: 50

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430.

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

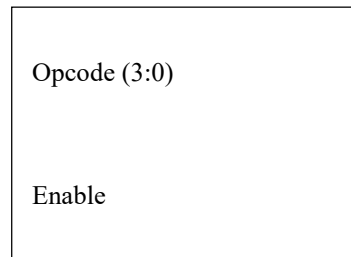
HDL LAB
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10ECL48	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/AceX/Max/Spartan/Sinfi/TK Base or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

PROGRAMMING (using VHDL /Verilog)

1. Write HDL code to realize all the logic gates
2. Write a HDL program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
2. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
3. Write a model for 32 bit ALU using the schematic diagram shown below
A (31:0) B (31:0)



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line is high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the given in example below.

OPCODE	ALU OPERATION
1.	A + B
2.	A – B
3.	A Complement
4.	A * B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

4. Develop the HDL code for the following flip-flops, SR, D, JK, T.
5. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters

INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on the given seven segment display and LCD and accepting Hex key pad input data.
 2. Write HDL code to control speed, direction of DC and Stepper motor.
 3. Write HDL code to accept 8 channel Analog signal, Temperature sensors and display the data on LCD panel or Seven segment display.
 4. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.
 5. Write HDL code to simulate Elevator operations
 - 6.** Write HDL code to control external lights using relays.
-

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of Management - Management as a Science, Art or Profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-Early Management Approaches-Modern Management Approaches.

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

UNIT - 3

ORGANISING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees – Centralisation Vs Decentralisation of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship - Evolution of

Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI - Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

TEXT BOOKS:

1. **Principles of Management** - P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th Edition, 2010
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House.
3. **Entrepreneurship Development** - Small Business Enterprises - Poornima M Charantimath - Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development Robert Lusier – Thomson.
2. **Entrepreneurship Development** - S S Khanka - S Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education /PHI -17th Edition, 2003.

DIGITAL SIGNAL PROCESSING

Subject Code	: 10EC52	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.

UNIT - 2

Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

UNIT - 3

Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).

UNIT - 4

Radix-2 FFT algorithm for the computation of DFT and IDFT—decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform

UNIT - 5

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations.

UNIT - 6

Implementation of discrete-time systems: Structures for IIR and FIR systems- direct form I and direct form II systems, cascade, lattice and parallel realization.

UNIT - 7

FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlett and Kaiser windows, FIR filter design using frequency sampling technique.

UNIT - 8

Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

TEXT BOOK:

1. **Digital signal processing – Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. **Digital Signal Processing**, Lee Tan: Elsvier publications, 2007

ANALOG COMMUNICATION

Subject Code	: 10EC53	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

UNIT - 2

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

UNIT - 3

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves.

UNIT - 4

VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

UNIT - 5

ANGLE MODULATION (FM)-I: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

UNIT - 6

ANGLE MODULATION (FM)-II: Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

UNIT - 7

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

UNIT - 8

NOISE IN CONTINUOUS WAVE MODULATION SYSTEMS: Introduction, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM,.

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 5th Edition, John Wiley, India Pvt. Ltd, 2009.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, Oxford University Press., 4th ed, 2010,
2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. **Communication Systems: Singh and Sapre: Analog and digital** TMH 2nd , Ed 2007.

MICROWAVES AND RADAR

Subject Code	: 10EC54	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MICROWAVE TRANSMISSION LINES: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors.

UNIT - 2

MICROWAVE WAVEGUIDES AND COMPONENTS: Introduction, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators.

UNIT - 3

MICROWAVE DIODES,

Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers
Other diodes: PIN diodes, Schottky barrier diodes.

UNIT - 4

Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi port networks.

UNIT - 5

Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees.

UNIT - 6

STRIP LINES: Introduction, Microstrip lines, Parallèle strip lines, Coplanar strip lines, Shielded strip Lines.

UNIT - 7

AN INTRODUCTION TO RADAR: Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, the origins of Radar.

UNIT - 8

MTI AND PULSE DOPPLER RADAR: Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

TEXT BOOKS:

1. **Microwave Devices and circuits-** Liao / Pearson Education.
2. **Introduction to Radar systems-**Merrill I Skolnik, 3rd Ed, TMH, 2001.
3. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.

REFERENCE BOOK:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.

INFORMATION THEORY AND CODING

Subject Code	: 10EC55	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

UNIT - 2

SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

UNIT - 3

FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

UNIT - 4

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT - 5

INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

UNIT - 6

Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

UNIT - 7

RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

UNIT - 8

Convolution Codes, Time domain approach. Transform domain approa

TEXT BOOKS:

1. **Digital and analog communication systems**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. **Digital communication**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **ITC and Cryptography**, Ranjan Bose, TMH, II edition, 2007
2. **Digital Communications** - Glover and Grant; Pearson Ed. 2nd Ed 2008.
- 3.

FUNDAMENTALS OF CMOS VLSI

Subject Code	: 10EC56	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

BASIC MOS TECHNOLOGY: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.

MOS TRANSISTOR THEORY: Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

UNIT - 2

CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Tutorial exercises.

Basic Physical Design of Simple logic gates.

UNIT - 3

CMOS LOGIC STRUCTURES: CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL).

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

SCALING OF MOS CIRCUITS: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

UNIT - 5

CMOS SUBSYSTEM DESIGN: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations.

Clocking Strategies

UNIT - 6

CMOS SUBSYSTEM DESIGN PROCESSES: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

UNIT - 7

MEMORY, REGISTERS AND CLOCK: Timing considerations. Memory elements. Memory cell arrays.

UNIT - 8

TESTABILITY: Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability.

TEXT BOOKS:

1. **CMOS VLSI Design – A Circuits and Systems Perspective. 3rd Edition.** N.H. Weste and David Harris. Addison-Wesley, 2005. (Refer to <http://www.cmosvlsi.com>)
2. **Principles of CMOS VLSI Design: A Systems Perspective,** Neil H. E. Weste, K. Eshragian, and ??? 3rd edition, Pearson Education (Asia) Pvt. Ltd., 200?. (Shift to the latest edition.)
3. **Basic VLSI Design -** Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994), 2005.

REFERENCE BOOKS:

1. R. Jacob Baker. CMOS Circuit Design, Layout and Simulation. John Wiley India Pvt. Ltd, 2008
2. **Fundamentals of Semiconductor Devices,** M. K. Achuthan and K. N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. **CMOS Digital Integrated Circuits: Analysis and Design,** Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
4. **Analysis and Design of Digital Integrated Circuits -** D.A Hodges, H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

DIGITAL SIGNAL PROCESSING LABORATORY

Subject Code	: 10ECL57	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

A LIST OF EXPERIMENTS USING MATLAB / SCILAB / OCTAVE / WAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system

REFERENCE BOOKS:

1. **Digital signal processing using MATLAB** - Sanjeet Mitra, TMH, 2001
2. **Digital signal processing using MATLAB** - J. G. Proakis & Ingale, MGH, 2000
3. **Digital Signal Processors**, B. Venkataramani and Bhaskar, TMH, 2002

ANALOG COMMUNICATION LAB + LIC LAB

Subject Code	: 10ECL58	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

**EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW
- 2009 CAN BE USED FOR VERIFICATION AND TESTING.**

1. Second order active LPF and HPF
2. Second order active BPF and BE
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
 - a. Astable multivibrator for given frequency and duty cycle
 - b. Monostable multivibrator for given pulse width W
7. IF amplifier design
8. Amplitude modulation using transistor/FET (Generation and detection)
9. Pulse amplitude modulation and detection
10. PWM and PPM
11. Frequency modulation using 8038/2206
12. Precision rectifiers – both Full Wave and Half Wave.

VI SEMESTER

DIGITAL COMMUNICATION

Subject Code	: 10EC61	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery.

UNIT - 2

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, robust quantization.

UNIT - 3

DPCM, DM, applications. Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals.

UNIT - 4

ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

UNIT - 5

DIGITAL MODULATION TECHNIQUES: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques.

UNIT - 6

Detection and estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

UNIT - 7

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

UNIT - 8

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency

hop spread spectrum, applications.

TEXT BOOK:

1. **Digital communications**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **Digital and Analog communication systems**, Simon Haykin, John Wiley India Pvt. Ltd, 2008
2. **An introduction to Analog and Digital Communication**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 2008.
3. **Digital communications** - Bernard Sklar: Pearson education 2007

MICROPROCESSOR

Subject Code	: 10EC62	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing, The 8086

UNIT - 2

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators

UNIT - 3

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display

UNIT - 4

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples

UNIT - 5

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor

UNIT - 6

8086 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples

UNIT - 7

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the universal serial bus (USB)

UNIT - 8

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.

TEXT BOOKS:

1. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and G. A. Gibson, 2E PHI -2003
2. **The Intel Microprocessor, Architecture, Programming and Interfacing**-Barry B. Brey, 6e, Pearson Education / PHI, 2003

REFERENCE BOOKS:

1. **Microprocessor and Interfacing- Programming & Hardware**, Douglas hall, 2nd, TMH, 2006.
2. **Advanced Microprocessors and Peripherals** - A.K. Ray and K.M. Bhurchandi, TMH, 2nd, 2006.
3. **8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware & Applications** - Triebel and Avtar Singh, 4e, Pearson Education, 2003

MICROELECTRONICS CIRCUITS

Subject Code : **10EC63**

No. of Lecture Hrs/Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

UNIT – 1

MOSFETS: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation modes, single stage MOS amplifiers. MOSFET internal capacitances and high frequency modes, Frequency response of CS amplifiers, CMOS digital logic inverter, detection type MOSFET.

UNIT -2

Single Stage IC Amplifier: IC Design philosophy, CoUmparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response.

UNIT – 3

Single Stage IC amplifiers (continued): CS and CF amplifiers with loads, high frequency response of CS and CF amplifiers, CG and CB amplifiers with active loads, high frequency response of CG and CB amplifiers, Cascade amplifiers. CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance. SPICE examples.

UNIT – 4

Differences and Multistage Amplifiers: The MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers. Multistage amplifier. SPICE examples.

UNIT – 5

Feedback. General Feedback structure. Properties of negative feedback. Four basic feedback topologies. Series-Shunt feedback. Determining the loop gain. Stability problem. Effect of feedback an amplifier poles. Stability study using Bode plots. Frequency compensation. SPICE examples.

UNIT - 6

Operational Amplifiers: The two stage CMOS Op-amp, folded cascade CMOS op-amp, 741 op-amp circuit, DC analysis of the 741, small signal analysis of 741, gain, frequency response and slew rate of 741. Data Converters. A-D and D-A converters.

UNIT – 7 & 8

Digital CMOS circuits. Overview. Design and performance analysis of CMOS inverter. Logic Gate Circuits. Pass-transistor logic. Dynamic Logic Circuits. SPICE examples.

Text Book:

1. “**Microelectronic Circuits**”, Adel Sedra and K.C. Smith, 5th Edition, Oxford University Press, Interantional Version, 2009.

Reference Book:

1. “**Fundamentals of Microelectronics**”, Behzad Razavi, John Wiley India Pvt. Ltd, 2008.
2. “**Microelectronics – Analysis and Design**”, Sundaram Natarajan, Tata McGraw-Hill, 2007

ANTENNAS AND PROPAGATION

Subject Code	: 10EC64	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna filed zones.

UNIT - 2

POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources. Endfire array and Broadside array.

UNIT - 3

ELECTRIC DIPOLES AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole(no derivation of field components), radiation resistance of short dipole, radiation resistances of $\lambda/2$ Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

UNIT - 4 & 5

LOOP, SLOT, PATCH AND HORN ANTENNA: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Babinet’s principle and complementary antennas,

impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas.

UNIT - 6

ANTENNA TYPES: Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna, high-resolution data, intelligent antennas, antenna for remote sensing.

UNIT - 7 & 8

RADIO WAVE PROPAGATION: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.

TROPOSPHERE WAVE PROPAGATION: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

TEXT BOOKS:

1. **Antennas and Wave Propagation**, John D. Krauss, 4th Edn, McGraw-Hill International edition, 2010.
2. **Antennas and Wave Propagation** - Harish and Sachidananda: Oxford Press 2007

REFERENCE BOOKS:

1. **Antenna Theory Analysis and Design** - C A Balanis, 3rd Edn, John Wiley India Pvt. Ltd, 2008
2. **Antennas and Propagation for Wireless Communication Systems** - Sineon R Saunders, John Wiley, 2003.
3. **Antennas and wave propagation** - G S N Raju: Pearson Education 2005

OPERATING SYSTEMS

Subject Code	: 10EC65	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS:

Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating

systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

UNIT - 2

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

UNIT - 3

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris.

UNIT - 4

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

UNIT - 5

VIRTUAL MEMORY: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

UNIT - 6

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

UNIT - 7

SCHEDULING: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX.

UNIT - 8

MESSAGE PASSING: Implementing message passing, Mailboxes, Inter process communication in UNIX.

TEXT BOOK:

1. **“Operating Systems - A Concept based Approach”**, D. M. Dhamdhare, TMH, 3rd Ed, 2010.

REFERENCE BOOK:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.
3. **Design of Operating Systems**, Tennambhaum, TMH, 2001.

ADVANCED COMMUNICATION LAB

Subject Code	: 10ECL67	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

LIST OF EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW – 2009 can be used for verification and testing.

1. TDM of two band limited signals.
2. ASK and FSK generation and detection
3. PSK generation and detection
4. DPSK generation and detection
5. QPSK generation and detection
6. PCM generation and detection using a CODEC Chip
7. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture
8. Analog and Digital (with TDM) communication link using optical fiber.
9. Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench
10. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).
11. Determination of coupling and isolation characteristics of a stripline (or microstrip) directional coupler
12. (a) Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate.

(b) Measurement of power division and isolation characteristics of a microstrip 3 dB power divider.

MICROPROCESSOR LAB

Subject Code	: 10ECL68	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

I) Programs involving

- 1) Data transfer instructions like:
 - i] Byte and word data transfer in different addressing modes.
 - ii] Block move (with and without overlap)
 - iii] Block interchange

- 2) Arithmetic & logical operations like:
 - i] Addition and Subtraction of multi precision nos.
 - ii] Multiplication and Division of signed and unsigned Hexadecimal nos.
 - iii] ASCII adjustment instructions
 - iv] Code conversions
 - v] Arithmetic programs to find square cube, LCM, GCD, factorial

- 3) Bit manipulation instructions like checking:
 - i] Whether given data is positive or negative
 - ii] Whether given data is odd or even
 - iii] Logical 1's and 0's in a given data
 - iv] 2 out 5 code
 - v] Bit wise and nibble wise palindrome

- 4) Branch/Loop instructions like:
 - i] Arrays: addition/subtraction of N nos.
Finding largest and smallest nos.
Ascending and descending order
 - ii] Near and Far Conditional and Unconditional jumps, Calls and Returns

- 5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.

- 6) Programs involving Software interrupts
Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console
- II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card
 - a) Matrix keyboard interfacing
 - b) Seven segment display interface
 - c) Logical controller interface
 - d) Stepper motor interface
- III) Other Interfacing Programs
 - a) Interfacing a printer to an X86 microcomputer
 - b) PC to PC Communication

ELECTIVE – GROUP A

ANALOG AND MIXED MODE VLSI DESIGN

Subject Code	: 10EC661	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

(Text Book 1)

UNIT 1

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT 2

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT 3

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

(Text Book 2)

UNIT 4:

Data Converter SNR: Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating

UNIT - 2

Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

UNIT – 3&4

SYNTHESIS FOR LOW POWER: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

UNIT – 5&6

DESIGN AND TEST OF LOW-VOLTAGE CMOS CIRCUITS: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V_{gs} , steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

UNIT - 7

LOW ENERGY COMPUTING: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

UNIT - 8

SOFTWARE DESIGN FOR LOW POWER: Introduction, sources of power dissipation, power estimation and optimization.

TEXT BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy and Sharat C Prasad, John Wiley Pvt. Ltd, 2008.

DATA STRUCTURE USING C++

Subject Code : **10EC665**

IA Marks : 25

No. of Lecture Hrs/Week : 04

Exam Hours : 03

UNIT - 1

INTRODUCTION: Functions and parameters, Dynamic memory allocation classis, Testing and debugging. Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing simulating pointers.

UNIT - 2

ARRAYS AND MATRICES: Arrays, Matrices, Special matrices spare matrices.

UNIT - 3

STACKS: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications.

UNIT - 4

Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked Linked representation, Applications.

UNIT - 5

SKIP LISTS AND HASHING: Dictionaries, Linear representation, Skip list presentation, Hash table representation.

UNIT - 6

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.

UNIT - 7

PRIORITY QUEUES: Linear lists, Heaps, Leftist trees.

UNIT-8

Search Trees: Binary search trees, B-trees, Applications.

TEXT BOOK:

1. **Data structures, Algorithms, and applications in C++** - Sartaj Sahni, McGraw Hill.2000.

REFERENCE BOOKS:

1. **Object Oriented Programming in C++** - Balaguruswamy. TMH, 1995.
2. **Programming in C++** - Balaguruswamy. TMH, 4th, 2010 .

DIGITAL SYSTEMS DESIGN USING VHDL

Subject Code	: 10EC666	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

Resolution and sampling frequency – Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi channel analog inputs. Concept of universal DAQ card – Use of timer-counter and analog outputs on the universal DAQ card.

UNIT 3

Cluster of Instruments in System: Interfacing of external instruments to a PC – RS 232C, RS – 422, RS 485 and USB standards – IEEE 488 standard – ISO –OSI model for series bus – introduction to bus protocols of MOD bus and CAN bus.

UNIT 4

Graphical Programming Environment in VI: Concepts of graphical programming – Lab-view software – Concept of VIs and sub VIs – Display types – Digital – Analog – Chart – Oscilloscope types – Loops – Case and sequence structures – Types of data – Arrays – Formulate nodes – Local and Global variables – String and file I/O.

UNIT 5

Analysis Tools and Simple Application in VI: Fourier transform – Power spectrum – Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – PID controller – CRO emulation – Simulation of a simple second order system – Generation of HTML page.

Reference Books:

1. S. Gupta and J P Gupta, "PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994
2. Peter W Gofton , "Understanding Serial Communication", Sybes International, 2000
3. Robert H. Bishop, "Learning with Lab-View" Prentice Hall, 2009
4. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
5. Ernest O. Doebelin and Dhanesh N Manik, " Measurement Systems – Application and Design", 5th Edn, TMH, 2007.

VII SEMESTER

COMPUTER COMMUNICATION NETWORKS

Subject Code	: 10EC71	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC.

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation.

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Backbone Networks, Virtual LANs

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: 10EC72	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point-to-point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT BOOKS:

1. "**Optical Fiber Communication**", Gerd Keiser, 4th Ed., MGH, 2008.
2. "**Optical Fiber Communications**", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: 10EC73	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base drive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1ϕ fully controlled converters, Dual converters, 1ϕ semi converters (all converters with R & RL load).

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with resistive loads and Inductive loads, numerical problems.

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification, Switch mode regulators – buck, boost and buck – boost regulators.

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1ϕ bridge inverter, voltage control of 1ϕ invertors, current source invertors, Variable DC link inverter.

TEXT BOOKS:

1. **“Power Electronics”** - M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
2. **“Power Electronics”** - M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

1. **“Power Electronics, Essentials and Applications”, L Umanand,** John Wiley India Pvt. Ltd, 2009.
2. **“Power Electronics”** , Daniel W. Hart, McGraw Hill, 2010.
3. **“Power Electronics”**, V Nattarasu and R.S. Anandamurthy, Pearson/Sanguine Pub. 2006.

EMBEDDED SYSTEM DESIGN

Subject Code	: 10EC74	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.

UNIT 2:

The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor
 The Hardware Side: Storage Elements and Finite-State Machines (2 hour)
 The concepts of State and Time, The State Diagram, Finite State Machines-A Theoretical Model.

UNIT 3:

Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation.

UNIT 4:

Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The

Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project.

UNIT 5 & 6:

Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited

UNIT 7 & 8:

Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance

Text Book:

1. **Embedded Systems – A contemporary Design**
Tool, James K. Peckol, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. **Embedded Systems: Architecture and Programming**, Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Programming for Embedded Systems**, Dreamtech Software Team, John Wiley India Pvt. Ltd, 2008

VLSI LAB

Subject Code : **10ECL77**
No. of Practical Hrs/Week : 03
Total no. of Practical Hrs. : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

(Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used)

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesize** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

- i. An inverter
- ii. A Buffer
- iii. Transmission Gate
- iv. Basic/universal gates
- v. Flip flop -RS, D, JK, MS, T
- vi. Serial & Parallel adder
- vii. 4-bit counter [Synchronous and Asynchronous counter]
- viii. Successive approximation register [SAR]

** An appropriate constraint should be given*

PART - B

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:

- a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis

b. **Draw the Layout** and verify the DRC, ERC

c. Check for LVS

d. Extract RC and back annotate the same and verify the Design

e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:

- a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis

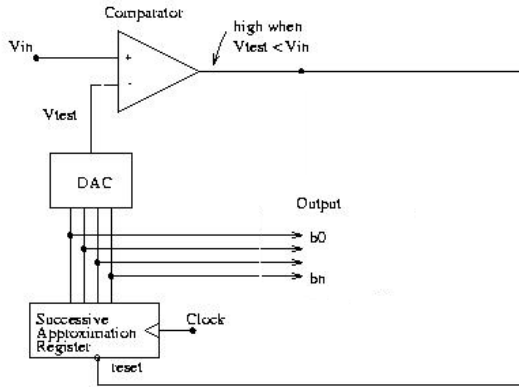
- iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier
 - ii) Common source and Common Drain amplifier

- 3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



- * Appropriate specification should be given.
- ** Applicable Library should be added & information should be given to the Designer.
- *** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: 10ECL78	IA Marks	: 25
No. of Practical Hrs/Week:	: 03	Exam Hours	: 03
Total no. of Practical Hrs. :	: 42	Exam Marks	: 50

Any five converter circuits experiment from the below list **must be** simulated using the **spice-simulator**.

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT.
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using i) LC circuit ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of a separately excited DC motor.
11. Speed control of universal motor.

12. Speed control of stepper motor.

13. Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: 10EC751	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control.

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOK:

1. **“Digital Signal Processing”**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Iffachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **“Digital Signal Processors”**, B Venkataramani and M Bhaskar TMH, 2nd, 2010
3. **“Architectures for Digital Signal Processing”**, Peter Pirsch John Wiley, 2008

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	: 10MS752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 10
			0

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

Multiple Inheritances, public, private & protected inheritance, Class scope under Inheritance.

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

REAL-TIME SYSTEMS

Subject Code	: 10EC762	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hatley and Pirbhai Method.

TEXT BOOKS:

1. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: 10EC81	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2nd, 2009.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, “**Wireles and Mobile Network concepts and protocols**”, John Wiley India Pvt. Ltd, 1st edition, 2010.
5. “**Wireless Communication – Principles & Practice**”, T.S. Rappaport, PHI 2001.

DIGITAL SWITCHING SYSTEMS

Subject Code	: 10EC82	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis.

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis.

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood: Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India India Pvt. Ltd, 3rd Ed, 2008.

ELECTIVE –4 (GROUP D)

DISTRIBUTED SYSTEM

Subject Code	: 10EC831	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Client-server communication, Group communication.

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

UNIT - 2

SYMMETRIC CIPHERS: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

UNIT - 3

Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions.

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard.

UNIT - 5

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.

UNIT - 6

Intruders, Intrusion Detection, Password Management.

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures.

UNIT - 8

Firewalls Design Principles, Trusted Systems.

TEXT BOOK:

1. **Cryptography and Network Security**, William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

OPTICAL NETWORKS

Subject Code

: **10EC833**

IA Marks

: 25

No. of Lecture Hrs/Week : 04
Total no. of Lecture Hrs. : 52

Exam Hours : 03
Exam Marks : 100

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons.

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers.

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters.

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks.

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations.

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment

considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

TEXT BOOK:

1. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

1. **Optical Communication Networks:** Biswajit Mukherjee: TMG 1998.
2. **Optical Networks,** Ulysees Black: Pearson education 2007.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: 10EC834	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE:

Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV.

UNIT - 5

GSM

Subject Code	: 10EC843	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers.

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna.

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. **MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services.

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

TEXT BOOK:

1. **“Principles of Applications of GSM”**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication**, [Friedhelm Hillebrand](#), John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: 10EC844	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols.

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT - 6

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a transport layer protocol

for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning.

UNIT - 8

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

TEXT BOOK:

1. “Ad hoc wireless Networks”, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. “Ad hoc wireless Networks”, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. “Ad hoc wireless Networking”, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: 10EC845	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens , sampling and quantization, image enhancement, image restoration.

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring.

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations.

SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics -III*	04		03	80	20	100	4
2	15EC32	Analog Electronics	04		03	80	20	100	4
3	15EC33	Digital Electronics	04		03	80	20	100	4
4	15EC34	Network Analysis	04		03	80	20	100	4
5	15EC35	Electronic Instrumentation	04		03	80	20	100	4
6	15EC36	Engineering Electromagnetics	04		03	80	20	100	4
7	15ECL37	Analog Electronics Lab		1I+2P	03	80	20	100	2
8	15ECL38	Digital Electronics Lab		1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP31	Additional Mathematics - I	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical / Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT41	Engineering Mathematics -IV*	04		03	80	20	100	4
2	15EC42	Microprocessor	04		03	80	20	100	4
3	15EC43	Control Systems	04		03	80	20	100	4
4	15EC44	Signals and Systems	04		03	80	20	100	4
5	15EC45	Principles of Communication Systems	04		03	80	20	100	4
6	15EC46	Linear Integrated Circuits	04		03	80	20	100	4
7	15ECL47	Microprocessor Lab		11+2P	03	80	20	100	2
8	15ECL48	Linear ICs and Communication Lab		11+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP41	Additional Mathematics - II	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical /Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15ES51	Management and Entrepreneurship Development	04		03	80	20	100	4
2	15EC52	Digital Signal Processing	04		03	80	20	100	4
3	15EC53	Verilog HDL	04		03	80	20	100	4
4	15EC54	Information Theory & Coding	04		03	80	20	100	4
5	15EC55X	Professional Elective-1	03		03	80	20	100	3
6	15EC56X	Open Elective-1	03		03	80	20	100	3
7	15ECL57	DSP Lab		11+2P	03	80	20	100	2
8	15ECL58	HDL Lab		11+2P	03	80	20	100	2
TOTAL			22	06	24	640	160	800	26

Professional Elective-1		Open Elective-1	
15EC553	Operating System	15EC562	Object Oriented Programming in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15EC61	Digital Communication	04		03	80	20	100	4
2	15EC62	ARM Microcontroller & Embedded Systems	04		03	80	20	100	4
3	15EC63	VLSI Design	04		03	80	20	100	4
4	15EC64	Computer Communication Networks	04		03	80	20	100	4
5	15EC65X	Professional Elective-2	03		03	80	20	100	3
6	15EC66X	Open Elective-2	03		03	80	20	100	3
7	15ECL67	Embedded Controller Lab		1I+2P	03	80	20	100	2
8	15ECL68	Computer Networks Lab		1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective-2		Open Elective-2	
15EC653	Artificial Neural Network	15EC661	Data Structures in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			15EC	
			Theory	Practical/Drawing	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	15EC71	Microwave and Antennas	04		03	20	80	100	4
2	15EC72	Digital Image Processing	04		03	20	80	100	4
3	15EC73	Power Electronics	04		03	20	80	100	4
4	15XX74X	Professional Elective-3	03		03	20	80	100	3
5	15EC75X	Professional Elective-4	03		03	20	80	100	3
6	15ECL76	Advanced Communication Lab		1I+2P	03	20	80	100	2
7	15ECL77	VLSI Lab		1I+2P	03	20	80	100	2
8	15ECP78	Project Work Phase-I + Project work Seminar		03		100	-	100	2
TOTAL			18	09	21	240	560	800	24

Professional Elective-3		Professional Elective-4	
15EC743	Real Time System	15EC751	DSP algorithms & Architecture

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EC81	Wireless Cellular and LTE 4G Broadband	4	-	3	20	80	100	4
2	15EC82	Fiber Optics & Networks	4	-	3	20	80	100	4
3	15EC83X	Professional Elective-5	3	-	3	20	80	100	3
4	15EC84	Internship/Professional Practice	Industry Oriented		3	50	50	100	2
5	15ECP85	Project Work	-	6	3	100	100	200	6
6	15ECS86	Seminar	-	4	-	100	-	100	1
TOTAL			11	10	15	310	390	700	20

Professional Elective-5	
15EC833	RADAR Engg.

**B.E., III Semester, Electronics & Communication Engineering
/Telecommunication Engineering**

ENGINEERING MATHEMATICS-III B.E., III Semester, Common to all Branches [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Introduce most commonly used analytical and numerical methods in the different engineering fields. • Learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods. • Solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Modules			RBT Level
Module-1			
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			L1, L2, L4
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			L2, L3, L4
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) -Problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.			L3
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof)-Problems.			L3

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems.</p>	<p>L3, L4</p> <p>L2, L4</p>
<p>Course outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functionals and solve the simple problems of the calculus of variations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i> 2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
<p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - I
B.E., III Semester, Common to all Branches
(A Bridge course for Lateral Entry students of III Sem. B. E.)
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15MATDIP31	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation. • Solve first order differential equations. 			
Modules			RBT Level
Module-1			
<p>Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).</p> <p>Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems.</p>			L1
Module-2			
<p>Differential Calculus: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Leibnitz's theorem (without proof). Polar curves-angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application to Jacobians.</p>			L1, L2
Module-3			
<p>Integral Calculus: Statement of reduction formulae for $\sin^n x$, $\cos^n x$, and $\sin^m x \cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.</p>			L1, L2
Module-4			
<p>Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.</p>			L1, L2
Module-5			
<p>Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types.</p>			L1, L2

<p>Course outcomes: On completion of the course, students are able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in related area. • Use derivatives and partial derivatives to calculate rates of change of multivariate functions. • Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region. • Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions. • Recognize and solve first-order ordinary differential equations occurring in different branches of engineering. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.</i> 	

ANALOG ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain various BJT parameters, connections and configurations. • Explain BJT Amplifier, Hybrid Equivalent and Hybrid Models. • Explain construction and characteristics of JFETs and MOSFETs. • Explain various types of FET biasing, and demonstrate the use of FET amplifiers. • Construct frequency response of BJT and FET amplifiers at various frequencies. • Analyze Power amplifier circuits in different modes of operation. • Construct Feedback and Oscillator circuits using FET. 			
Modules			RBT Level
Module -1			
<p>BJT AC Analysis: BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid Model.</p>			L1, L2,L3
Module -2			
<p>Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.</p> <p>FET Amplifiers: JFET small signal model, Fixed bias configuration, Self bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.</p>			L1, L2, L3
Module -3			
<p>BJT and JFET Frequency Response: Logarithms, Decibels, Low frequency response - BJT Amplifier with RL, Low frequency response-FET Amplifier, Miller effect capacitance, High frequency response - BJT Amplifier, High frequency response-FET Amplifier, Multistage Frequency Effects.</p>			L1, L2, L3
Module -4			

<p>Feedback and Oscillator Circuits: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wien bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Power Amplifiers: Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers. Voltage Regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers. • Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT. • Calculate the AC gain and impedance for BJT using re and h parameters models for CE and CC configuration. • Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model. • Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics. • Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Robert L. Boylestad and Louis Nashelsky, “Electronics devices and Circuit theory”, Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Adel S. Sedra and Kenneth C. Smith, “Micro Electronic Circuits Theory and Application”, 5th Edition ISBN:0198062257 2. Fundamentals of Microelectronics, Behzad Razavi, John Wiley ISBN 2013 978-81-265-2307-8 3. J.Millman & C.C.Halkias Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424. 	

DIGITAL ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques. • Design combinational logic circuits. • Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators. • Describe Latches and Flip-flops, Registers and Counters. • Analyze Mealy and Moore Models. • Develop state diagrams Synchronous Sequential Circuits. 			
Modules			RBT Level
Module - 1			
<p>Principles of combination logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables.(Text 1, Chapter 3)</p>			L1, L2, L3
Module -2			
<p>Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.(Text 1, Chapter 4)</p>			L1, L2, L3
Module -3			
<p>Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations. (Text 2, Chapter 6)</p>			L1,L2
Module -4			
<p>Simple Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counters, Design of a synchronous mod-n counter using clocked T , JK , D and SR flip-flops. (Text 2, Chapter 6)</p>			L1,L2, L3

Module -5	
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. (Text 1, Chapter 6)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques. • Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators. • Explain the working of Latches and Flip Flops (SR,D,T and JK). • Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops. • Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. • Apply the knowledge gained in the design of Counters and Registers. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1. 2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002. ISBN 978-0-07-052906-9. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. D. P. Kothari and J. S Dhillon, “Digital Circuits and Design”, Pearson, 2016, ISBN:9789332543539. 2. Morris Mano, “Digital Design”, Prentice Hall of India, Third Edition. 3. Charles H Roth, Jr., “Fundamentals of logic design”, Cengage Learning. 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424. 	

NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC34	IA Marks	20
Number	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course enables students to:			
<ul style="list-style-type: none"> • Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power. • Explain network Thevenin's, Millman's, Superposition, Reciprocity, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits. • Explain the behavior of networks subjected to transient conditions. • Use applications of Laplace transforms to network problems. • Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response. • Study two port network parameters like Z, Y, T and h and their inter-relationships and applications. 			
Modules			RBT Level
Module -1			
Basic Concepts: Practical sources, Source transformations, Network reduction using Star - Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.			L1, L2,L3,L4
Module -2			
Network Theorems: Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem.			L1, L2, L3,L4
Module -3			
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.			L1, L2, L3,L4
Module -4			
Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q-Factor, Bandwidth.			L1, L2, L3,L4
Module -5			

<p>Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets.</p>	<p>L1, L2, L3,L4</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting. • Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions. • Calculate current and voltages for the given circuit under transient conditions. • Apply Laplace transform to solve the given network. • Evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits • Solve the given network using specified two port network parameter like Z or Y or T or h. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958. 2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010. 2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8thed, 2006. 3. Charles K Alexander and Mathew N O Sadiku, " Fundamentals of Electric Circuits", Tata McGraw-Hill, 3rd Ed, 2009. 	

ELECTRONIC INSTRUMENTATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define and describe accuracy and precision, types of errors, statistical and probability analysis. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of various Analog and Digital measuring instruments. • Describe basic concepts and operation of Digital Voltmeters and Microprocessor based instruments. • Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges. • Recognize and describe significance and working of different types of transducers. 			
Modules			RBT Level
<p>Module -1 Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations, Basics of Statistical Analysis. (Text 2)</p> <p>Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)</p> <p>Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. Transistor Voltmeter, Differential Voltmeter, True RMS Voltmeter, Considerations in Choosing an Analog Voltmeter, Multimeter. (Text 1)</p>			L1, L2, L3
Module -2			

<p>Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Continuous Balance DVM, $3\frac{1}{2}$-Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, Microprocessor based Ramp type DVM. (Text 1)</p> <p>Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, Microprocessor based Instruments. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -3</p>	
<p>Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Storage Oscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)</p> <p>Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, Square and Pulse Generator, Sweep Generator. (Text 1)</p>	<p>L1, L2</p>
<p>Module -4</p>	
<p>Measuring Instruments: Output Power Meters, Field Strength Meter, Stroboscope, Phase Meter, Vector Impedance Meter, Q Meter, Megger, Analog pH Meter. (Text 1)</p> <p>Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -5</p>	
<p>Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers, LVDT, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo diode and transistor, Temperature transducers-RTD. (Text 1)</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe instrument measurement errors and calculate them. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions. • Describe functional concepts and operation of various Analog measuring instruments to measure output power, field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance and pH. • Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers. • Utilize AC and DC bridges for passive component and frequency measurements. 	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.

Reference Books:

1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN:9789332556065.
2. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai & Sons. ISBN -81-7700-016-0

ENGINEERING ELECTROMAGNETICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient. • Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions. • Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions. • Infer the effects of magnetic forces, materials and inductance. • Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behaviour in different media • Acquire knowledge of Poynting theorem and its application of power flow. 			
Modules		RBT Level	
Module - 1			
<p>Coulomb's Law, Electric Field Intensity and Flux density Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density.</p>		L1, L2, L3	
Module -2			
<p>Gauss's law and Divergence Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem.</p> <p>Energy, Potential and Conductors Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current.</p>		L1, L2, L3	
Module -3			
<p>Poisson's and Laplace's Equations Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation.</p> <p>Steady Magnetic Field Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials.</p>		L1, L2, L3	
Module -4			

<p>Magnetic Forces Force on a moving charge, differential current elements, Force between differential current elements.</p> <p>Magnetic Materials Magnetisation and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials.</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Time-varying fields and Maxwell's equations Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.</p> <p>Uniform Plane Wave Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. • Determine potential and energy with respect to point charge and capacitance using Laplace equation. • Calculate magnetic field, force, and potential energy with respect to magnetic materials. • Apply Maxwell's equation for time varying fields, EM waves in free space and conductors. • Evaluate power associated with EM waves using Poynting theorem. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2009, ISBN-978-0-07-061223-5.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John Krauss and Daniel A Fleisch, " Electromagnetics with applications", McGraw-Hill. 2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson. 	

ANALOG ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL37	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:</p> <ul style="list-style-type: none"> • Rectifiers and Voltage Regulators. • BJT characteristics and Amplifiers. • JFET Characteristics and Amplifiers. • MOSFET Characteristics and Amplifiers • Power Amplifiers. • RC-Phase shift, Hartley, Colpitts and Crystal Oscillators. 			
NOTE: The experiments are to be carried using discrete components only.			
Laboratory Experiments:			
1. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency: (a) Full Wave Rectifier (b) Bridge Rectifier			
2. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).			
3. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.			
4. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.			
5. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.			
6. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.			
7. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.			

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
10. Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
11. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
12. Design and set-up the crystal oscillator and determine the frequency of oscillation.
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators. • Determine the characteristics of BJT and FET amplifiers and plot its frequency response. • Compute the performance parameters of amplifiers and voltage regulators • Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

DIGITAL ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL38	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Mark	80
RBT Level	L1, L2, L3	Exam Hour	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, realisation and verification of</p> <ul style="list-style-type: none"> • Demorgan's Theorem, SOP, POS forms • Full/Parallel Adders, Subtractors and Magnitude Comparator • Multiplexer using logic gates • Demultiplexers and Decoders • Flip-Flops, Shift registers and Counters 			
<p>NOTE:</p> <ol style="list-style-type: none"> 1. Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used. 2. For experiment No. 11 and 12 any open source or licensed simulation tool may be used. 			
Laboratory Experiments:			
1. Verify			
(a) Demorgan's Theorem for 2 variables.			
(b) The sum-of product and product-of-sum expressions using universal gates.			
2. Design and implement			
(a) Full Adder using basic logic gates.			
(b) Full subtractor using basic logic gates.			
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.			
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.			
5. Realize			
(a) 4:1 Multiplexer using gates.			
(b) 3-variable function using IC 74151(8:1MUX).			
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.			
7. Realize the following flip-flops using NAND Gates.			
(a) Clocked SR Flip-Flop (b) JK Flip-Flop.			
8. Realize the following shift registers using IC7474			
(a) SISO (b) SIPO (c) PISO (d) PIPO.			
9. Realize the Ring Counter and Johnson Counter using IC7476.			
10. Realize the Mod-N Counter using IC7490.			

11. Simulate Full- Adder using simulation tool.

12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
- Construct and test flips-flops, counters and shift registers.
- Simulate full adder and up/down counters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B.E E&C FOURTH SEMESTER SYLLABUS

ENGINEERING MATHEMATICS-IV			
B.E., IV Semester, Common to all Branches			
[As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits - 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. 			
Modules			RBT Level
Module-1			
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).			L1, L3
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method.			
Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$ -Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue's formula, problems.			L3
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems.			L1, L3,
Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z+(1/z)(z \neq 0)$ and bilinear transformations-problems.			L3
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.			L3

<p>Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.</p>	
<p>Module-5</p>	
<p>Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.</p>	<p>L3</p>
<p>Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.</p>	<p>L1</p>
<p>Course Outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods. • Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory. • Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing. • Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems. • Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering. • Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis. • Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events. • Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books: <i>1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	

2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i>	
Reference Books:	
<ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
Web Link and Video Lectures:	
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - II B.E., IV Semester, Common to all Branches (A Bridge course for Lateral Entry students of IV Sem. B. E.) [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MATDIP41	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand essential concepts of linear algebra. • Solve second and higher order differential equations. • Understand Laplace and inverse Laplace transforms and elementary probability theory. 			
Modules			RBT Level
Module-1			
Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.			L1,L3
Module-2			
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of undetermined coefficients and variation of parameters.			L1,L3
Module-3			
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only.			L1,L2
Module-4			
Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Application to solutions of Linear differential equations and simultaneous differential equations.			L1,L2
Module-5			
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples.			L1,L2
Course Outcomes: On completion of this course, students are able to:			
<ul style="list-style-type: none"> • Solve systems of linear equations in the different areas of linear algebra. • Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations. 			

<ul style="list-style-type: none"> • Describe Laplace transforms of standard and periodic functions. • Determine the general/complete solutions to linear ODE using inverse Laplace transforms. • Recall basic concepts of elementary probability theory and, solve problems related to the decision theory, synthesis and optimization of digital circuits. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10^h Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7^h Ed., 2007.</i> 	

MICROPROCESSORS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Familiarize basic architecture of 8086 microprocessor • Program 8086 Microprocessor using Assembly Level Language • Use Macros and Procedures in 8086 Programs • Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design • Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures 			
Modules			RBT Level
Module -1			
<p>8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text).</p> <p>Addressing modes, Machine language instruction formats, Machine coding the program (2.2, 2.1, 3.2 of Text).</p> <p>INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text).</p>			L1, L2, L3
Module -2			
<p>Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text).</p>			L1, L2, L3
Module -3			
<p>Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Passing parameters to procedures, Macros, Timing and Delays. (Chap. 4 of Text).</p>			L1, L2, L3
Module -4			

<p>8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).</p> <p>Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255 (Refer 5.3, 5.4, 5.5 of Text).</p>	<p>L1, L2, L3</p>
<p>Module 5</p>	
<p>Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes (refer 6.1 of Text).</p> <p>INT 21H DOS Function calls - for handling Keyboard and Display (refer Appendix-B of Text).</p> <p>Other Architectures: Architecture of 8088 (refer 1.10 upto 1.10.1 of Text) and Architecture of NDP 8087 (refer 8.3.1, 8.3.5 of Text).</p> <p>Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students will be able to:</p> <ul style="list-style-type: none"> • Explain the History of evaluation of Microprocessors, Architecture and instruction set of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086. • Write 8086 Assembly level programs using the 8086 instruction set • Write modular programs using procedures and macros. • Write 8086 Stack and Interrupts programming • Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors. • Use INT 21 DOS interrupt function calls to handle Keyboard and Display. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Book:

Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. **Microcomputer systems-The 8086 / 8088 Family** - Y.C. Liu and A. Gibson, 2nd edition, PHI -2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** - Kenneth J Ayala, CENGAGE Learning, 2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

CONTROL SYSTEMS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - IV (EC/TC)			
Subject Code	15EC43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the basic features, configurations and application of control systems. • Understand various terminologies and definitions for the control systems. • Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems. • Know how to find time response from the transfer function. • Find the transfer function via Masons' rule. • Analyze the stability of a system from the transfer function. 			
Modules			RBT Level
Module -1			
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems - Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.			L1, L2, L3
Module -2			
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).			L1, L2, L3
Module -3			
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.			L1, L2, L3
Module -4			

<p>Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalisation.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, the students will be able to</p> <ul style="list-style-type: none"> • Develop the mathematical model of mechanical and electrical systems • Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method • Determine the time domain specifications for first and second order systems • Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. • Determine the stability of a system in the frequency domain using Nyquist and bode plots • Develop a control system model in continuous and discrete time using state variable techniques 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: J.Nagarath and M.Gopal, “ Control Systems Engineering”, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Modern Control Engineering,” K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7. 2. “Automatic Control Systems”, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 3. “Feedback and Control System,” Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007. 	

SIGNALS AND SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the mathematical description of continuous and discrete time signals and systems. • Analyze the signals in time domain using convolution difference/differential equations • Classify signals into different categories based on their properties. • Analyze Linear Time Invariant (LTI) systems in time and transform domains. • Build basics for understanding of courses such as signal processing, control system and communication. 			
Modules			RBT Level
Module -1			
<p>Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.</p> <p>Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.</p> <p>Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.</p> <p>Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.</p>			L1, L2, L3
Module -2			
<p>Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.</p>			L1, L2, L3
Module -3			

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours). Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours).	L1, L2, L3
Module -4	
Fourier Representation of aperiodic Signals: FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours). FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours). Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours).	L1, L2, L3
Module -5	
Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems.	L1, L2, L3
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals. • Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems. • Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. • Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis. • Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems. 	
Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book:	
Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.	

Reference Books:

1. **Michael Roberts**, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan**, "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.

PRINCIPLES OF COMMUNICATION SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals. • Understand the concepts in Angle modulation for the design of communication systems. • Design simple systems for generating and demodulating frequency modulated signals. • Learn the concepts of random process and various types of noise. • Evaluate the performance of the communication system in presence of noise. • Analyze pulse modulation and sampling techniques. 			
Modules			RBT Level
Module - 1			
<p>AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency - Domain description, Switching modulator, Envelop detector.</p> <p>DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency - Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.</p> <p>SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text).</p>			L1, L2, L3
Module - 2			
<p>ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text).</p>			L1, L2, L3
Module - 3			

<p>RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions (refer Chapter 5 of Text).</p> <p>NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 4</p>	
<p>NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 5</p>	
<p>DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Determine the performance of analog modulation schemes in time and frequency domains. • Determine the performance of systems for generation and detection of modulated analog signals. • Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms. • Characterize the influence of channel on analog modulated signals • Determine the performance of analog communication systems. • Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Communication Systems, Simon Haykins & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 - 81 - 265 - 2151 - 7.</p>	
<p>Reference Books:</p>	

1. **Modern Digital and Analog Communication Systems**, B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems: Analog and Digital**, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

LINEAR INTEGRATED CIRCUITS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define and describe various parameters of Op-Amp, its characteristics and specifications. • Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits. • Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters. • Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate. • Describe and Sketch the various switching circuits of Op-Amps and analyze its operations. • Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs. 			
Modules			RBT Level
Module -1			
<p>Operational Amplifier Fundamentals: Basic Op-amp circuit, Op-Amp parameters - Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. OP-Amps as DC Amplifiers - Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet. (Text1)</p>			L1, L2,L3
Module -2			
<p>Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance - Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance - Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers. (Text1)</p>			L1, L2,L3
Module-3			
<p>More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider. (Text2)</p>			L1, L2,L3

Module -4	
<p>Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. (Text 1) Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. (Text 2)</p>	L1, L2,L3
Module -5	
<p>Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. (Text 2)</p>	L1, L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. • Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. • Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. • Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. • Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. • Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9. 2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4thedition, Reprint 2006, New Age International ISBN 978-81-224-3098-1. 	

Reference Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, "Linear Integrated Circuits: Analysis, Design & Applications," Wiley India, 1st Edition, 2015.
3. James Cox, "Linear Electronics Circuits and Devices", Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.

MICROPROCESSOR LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL47	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:

- i) Byte and word data transfer in different addressing Modes
- ii) Block move (with and without overlap)
- iii) Block interchange

2. Programs involving:

Arithmetic & logical operations like:

- i) Addition and Subtraction of multi precision nos.
- ii) Multiplication and Division of signed and unsigned Hexadecimal nos.
- iii) ASCII adjustment instructions.
- iv) Code conversions.

3. Programs involving:

Bit manipulation instructions like checking:

- i) Whether given data is positive or negative
- ii) Whether given data is odd or even
- iii) Logical 1's and 0's in a given data
- iv) 2 out 5 code
- v) Bit wise and nibble wise palindrome

4. Programs involving:

Branch/ Loop instructions like

- i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
- ii) Two application programs using Procedures and Macros (Subroutines).

<p>5. Programs involving</p> <p>String manipulation like string transfer, string reversing, searching for a string.</p>
<p>6. Programs involving</p> <p>Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.</p>
<p>7. Interfacing Experiments:</p> <p>Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)</p> <ol style="list-style-type: none"> 1. Matrix keyboard interfacing 2. Seven segment display interface 3. Logical controller interface 4. Stepper motor interface 5. ADC and DAC Interface (8 bit) 6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. • Understand assembler directives, branch, loop operations and DOS 21H Interrupts. • Write and execute 8086 assembly level programs to sort and search elements in a given array. • Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. • Utilize procedures and macros in programming 8086. • Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one question from software and one question from hardware interfacing to be set. • Students are allowed to pick one experiment from the lot. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

LINEAR ICS AND COMMUNICATION LAB

As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL48	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This laboratory course enables students to:

- Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp
- Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations.
- Design, Demonstrate and Analyze balance modulation and frequency synthesis.
- Demonstrate and Analyze pulse sampling and flat top sampling.

Laboratory Experiments:

1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.
3. Design active second order Butterworth low pass and high pass filters.
4. Design 4 bit R - 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
5. Design Adder, Integrator and Differentiator using Op-Amp.
6. Design of Monostable and Astable Multivibrator using 555 Timer.
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.
8. Amplitude modulation using transistor/FET (Generation and detection).
9. Frequency modulation using IC 8038/2206 and demodulation.
10. Design BJT/FET Mixer.
11. DSBSC generation using Balance Modulator IC 1496/1596.
12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C FIFTH SEMESTER SYLLABUS

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

B.E., V Semester, EC/TC/EI/BM/ML

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ES51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: This course will enable students to:

- Understand basic skills of Management
- Understand the need for Entrepreneurs and their skills
- Understand Project identification and Selection
- Identify the Management functions and Social responsibilities
- Distinguish between management and administration

Module-1	RBT Level
<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).</p> <p>Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making(Selected topics from Chapters 4 & 5, Text 1).</p>	L1, L2
Module-2	
<p>Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees-Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11,Text 1).</p> <p>Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow’s Need-Hierarchy Theory and Herzberg’s Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process (Selected topics from Chapters 15 to 18 and 9, Text 1).</p>	L1, L2
Module-3	
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).</p>	L1, L2

<p>Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship (Selected topics from Chapter 2, Text 2).</p>	
Module-4	
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only)(Selected topics from Chapter1, Text 2).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics from Chapter 4, Text 2).</p>	L1, L2
Module-5	
<p>Projects Management: AProject. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.</p> <p>Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.</p> <p>(Selected topics from Chapters 16 to 20 of Unit 3, Text 3).</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of Management and Entrepreneurship • Select a best Entrepreneurship model for the required domain of establishment • Describe the functions of Managers, Entrepreneurs and their social responsibilities • Compare various types of Entrepreneurs • Analyze the Institutional support by various state and central government agencies 	
<p>Question paper pattern</p> <ul style="list-style-type: none"> • The question paper will have TEN questions. • Each full question carries 16 marks. • There will be two full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

Reference Book:

Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

DIGITAL SIGNAL PROCESSING

B.E., V Semester, Electronics & Communication Engineering / Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

Modules

Module-1	RBT Level
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution.	L1, L2
Module-2	
Additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).	L1, L2, L3
Module-3	
Radix-2 FFT algorithm for the computation of DFT and IDFT-decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.	L1, L2, L3
Module-4	
Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation.	L1, L2, L3
Module-5	
Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling	L1, L2,

structure, Lattice structure. FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows.	L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine response of LTI systems using time domain and DFT techniques. • Compute DFT of real and complex discrete time signals. • Computation of DFT using FFT algorithms and linear filtering approach. • Solve problems on digital filter design and realize using digital computations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003. 2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010. 3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007. 	

Verilog HDL
**B.E., V Semester, Electronics & Communication Engineering/
 Telecommunication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Differentiate between Verilog and VHDL descriptions. • Learn different Verilog HDL and VHDL constructs. • Familiarize the different levels of abstraction in Verilog. • Understand Verilog Tasks and Directives. • Understand timing and delay Simulation. • Learn VHDL at design levels of data flow, behavioral and structural for effective modeling of digital circuits. 			
Module-1			RBT Level
<p>Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text1)</p> <p>Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1)</p>			L1, L2, L3
Module-2			
<p>Basic Concepts Lexical conventions, data types, system tasks, compiler directives. (Text1)</p> <p>Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1)</p>			L1, L2, L3
Module-3			
<p>Gate-Level Modeling Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)</p> <p>Dataflow Modeling Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1)</p>			L1, L2, L3
Module-4			
<p>Behavioral Modeling Structured procedures, initial and always, blocking and non-blocking</p>			L1, L2, L3

statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. (Text1)	
Module-5	
<p>Introduction to VHDL Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis, Design tool flow, Font conventions. Entities and Architectures: Introduction, A simple design, Design entities, Identifiers, Data objects, Data types, and Attributes. (Text 2)</p>	L1, L2, L3
<p>Course Outcomes: At the end of this course, students should be able to</p> <ul style="list-style-type: none"> • Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction. • Write simple programs in VHDL in different styles. • Design and verify the functionality of digital circuit/system using test benches. • Identify the suitable Abstraction level for a particular digital design. • Write the programs more effectively using Verilog tasks and directives. • Perform timing and delay Simulation. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition. 2. Kevin Skahill, “VHDL for Programmable Logic”, PHI/Pearson education, 2006. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science+Business Media, LLC, Fifth edition. 2. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL” Pearson (Prentice Hall), Second edition. 3. Padmanabhan, Tripura Sundari, “Design through Verilog HDL”, Wiley, 2016 or earlier. 	

INFORMATION THEORY AND CODING
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to:

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

Modules

Module-1	RBT Level
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources (Section 4.1, 4.2 of Text 1).	L1, L2, L3
Module-2	
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2). Encoding of the Source Output, Shannon’s Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1). Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm (Sections 3.6, 3.7, 3.8, 3.10 of Text 3).	L1, L2, L3
Module-3	
Information Channels: Communication Channels (Section 4.4 of Text 1). Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections 4.2, 4.3, 4.4, 4.6, 4.7 of Text 3).	L1, L2, L3
Module-4	

<p>Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.</p> <p>Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1).</p>	L1, L2, L3
Module-5	
<p>Some Important Cyclic Codes: Golay Codes, BCH Codes(Section 8.4 - Article 5 of Text 2).</p> <p>Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5 - Articles 1,2 and 3, 8.6- Article 1 of Text 2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> • Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source • Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms • Model the continuous and discrete communication channels using input, output and joint probabilities • Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes • Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996. 2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008. 3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007 2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering 	

3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

OPERATING SYSTEM
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC553	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the services provided by an operating system. • Understand how processes are synchronized and scheduled. • Understand different approaches of memory management and virtual memory management. • Understand the structure and organization of the file system • Understand interprocess communication and deadlock situations. 			
Module-1			RBT Level
<p>Introduction to Operating Systems OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).</p>			L1, L2
Module-2			
<p>Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, 4.2, 4.3, 4.4.1 of Text).</p>			L1, L2
Module-3			
<p>Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies (Topics from Sections 5.5 to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1 of Text).</p>			L1, L2
Module-4			
<p>File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from Sections 7.1 to 7.8 of Text).</p>			L1, L2, L3
Module-5			
<p>Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Resource state modelling, Deadlock detection algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to</p>			L1, L2, L3

11.5 of Text).

Course outcomes: After studying this course, students will be able to:

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Book:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition, 2001.
2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

DSP Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL57	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory=03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).
6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
(ii) DFT computation of square pulse and Sinc function etc.
7. Design and implementation of FIR filter to meet given specifications (using different window techniques).
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

9. Linear convolution of two sequences
10. Circular convolution of two sequences
11. N-point DFT of a given sequence
12. Impulse response of first order and second order system
13. Implementation of FIR filter

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.

- Modelling of discrete time signals and systems and verification of its properties and results.
- Implementation of discrete computations using DSP processor and verify the results.
- Realize the digital filters using a simulation tool and a DSP processor and verify the frequency and phase response.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

HDL Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL58	IA Marks	20
Number of Lecture Hours/Week	01 Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

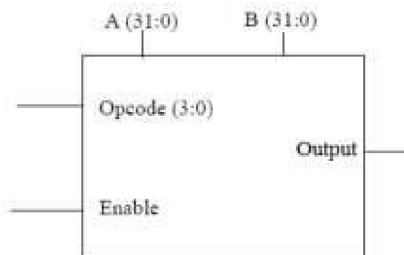
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesise the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

Part-A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer.
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
3. Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Write a Verilog code to model 32 bit ALU using the schematic diagram shown below



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU Operation
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

5. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
6. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters, using Verilog code.

Part-B: INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
3. Write HDL code to control speed, direction of DC and Stepper motor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.
6. Write HDL code to simulate Elevator operation.

Course Outcomes: At the end of this course, students should be able to:

- Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

Object Oriented Programming Using C++

B.E. V Semester (Open Elective)

[As per Choice Based Credit System (CBCS)scheme]

Subject Code	15EC562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs/ Module	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define Encapsulation, Inheritance and Polymorphism. • Solve the problem with object oriented approach. • Analyze the problem statement and build object oriented system model. • Describe the characters and behavior of the objects that comprise a system. • Explain function overloading, operator overloading and virtual functions. • Discuss the advantages of object oriented programming over procedure oriented programming. 			
Module -1			RBT Level
<p>Beginning with C++ and its features: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from Ch -2,3 of Text).</p>			L1, L2
Module -2			
<p>Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions (Selected Topics from Chap-4,5 of Text).</p>			L1, L2, L3
Module -3			
<p>Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text).</p>			L1, L2, L3
Module -4			
<p>Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).</p>			L1, L2, L3

Module -5	
Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text).	L1, L2, L3
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Explain the basics of Object Oriented Programming concepts. • Apply the object initialization and destroy concept using constructors and destructors. • Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. • Use the concept of inheritance to reduce the length of code and evaluate the usefulness. • Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. • Use I/O operations and file streams in programs. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.</p> <p>Reference Book: Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.</p>	

B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours/Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

Module-1	RBT Level
<p>Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p>Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2)</p>	L1, L2, L3
Module-2	
<p>Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4).</p>	L1, L2, L3
Module-3	
<p>Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM (Relevant topics in Text 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK</p>	

<p>generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12, 7.13).</p>	
Module-4	
<p>Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI-The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol-by-Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2).</p> <p>Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).</p>	L1, L2, L3
Module-5	
<p>Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Associate and apply the concepts of Bandpass sampling to well specified signals and channels. • Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. • Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. • Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p>	

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books:

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.

ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering**
[As per Choice Based Credit System (CBCS) scheme]

<u>ARM MICROCONTROLLER & EMBEDDED SYSTEMS</u>			
B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none">• Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.• Program ARM Cortex M3 using the various instructions and C language for different applications.• Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.• Develop the hardware software co-design and firmware design approaches.• Explain the need of real time operating system for embedded system applications.			
Module-1			
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) L1, L2			
Module-2			
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) L1, L2, L3			
Module-3			
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. (Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). L1, L2, L3			
Module-4			
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded			

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).

(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues - Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment - Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques

(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

L1, L2, L3

Course outcomes: After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

VLSI Design
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Module-1	RBT Level
<p>Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).</p> <p>Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).</p>	L1, L2
Module-2	
<p>MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.</p> <p>Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).</p>	L1, L2, L3
Module-3	
<p>Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters</p> <p>Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).</p>	L1, L2, L3
Module-4	
<p>Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).</p> <p>FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture, Physical design for FPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3).</p>	L1, L2, L3
Module-5	
<p>Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).</p>	L1, L2, L3

Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).

Course outcomes: At the end of the course, the students will be able to:

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Interpret Memory elements along with timing considerations
- Demonstrate knowledge of FPGA based system design
- Interpret testing and testability issues in VLSI Design
- Analyze CMOS subsystems and architectural issues with the design constraints.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. **“Basic VLSI Design”**- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994).
2. **“CMOS VLSI Design- A Circuits and Systems Perspective”**- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3. **“FPGA Based System Design”**- Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

COMPUTER COMMUNICATION NETWORKS
B.E., VI Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

COMPUTER COMMUNICATION NETWORKS B.E., VI Semester, Electronics & Communication Engineering / Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the layering architecture of OSI reference model and TCP/IP protocol suite. • Understand the protocols associated with each layer. • Learn the different networking architectures and their representations. • Learn the various routing techniques and the transport layer services. 			
Module-1			
<p>Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet. Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. L1, L2</p>			
Module-2			
<p>Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing. Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. L1, L2</p>			
Module-3			
<p>Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers. Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages. Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing.</p>			

DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. **L1, L2**

Module-4

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging Tools, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. **L1, L2, L3**

Module-5

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. **L1, L2**

Course Outcomes: At the end of the course, the students will be able to:

- Identify the protocols and services of Data link layer.
- Identify the protocols and functions associated with the transport layer services.
- Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
- Distinguish the basic network configurations and standards associated with each network.
- Construct a network model and determine the routing of packets using different routing algorithms.

Text Book:

Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016
ISBN: 1-25-906475-3

Reference Books:

1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4
2. Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282

ARTIFICIAL NEURAL NETWORKS
B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC653	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: The objectives of this course are:</p> <ul style="list-style-type: none"> • Understand the basics of ANN and comparison with Human brain • Provide knowledge on Generalization and function approximation and various architectures of building an ANN • Provide knowledge of reinforcement learning using neural networks • Provide knowledge of unsupervised learning using neural networks. 			
Module-1			RBT Level
<p>Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.</p>			L1, L2
Module-2			
<p>Supervised Learning: Perceptron learning and Non Separable sets, -Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.</p>			L1, L2, L3
Module-3			
<p>Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.</p>			L1, L2, L3
Module-4			
<p>Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.</p>			L1, L2, L3
Module-5			
<p>Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.</p>			L1, L2, L3

Course outcomes: At the end of the course, students should be able to:

- Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
- Understand the concepts and techniques of neural networks through the study of the most important neural network models.
- Evaluate whether neural networks are appropriate to a particular application.
- Apply neural networks to particular applications, and to know what steps to take to improve performance.

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. **Introduction to Artificial Neural Systems**-J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks**-B. Yegnanarayana, PHI, New Delhi 1998.

**6th Semester Open Electives Syllabus for the courses offered by
EC/TC Board:**

DATA STRUCTURE USING C++ B.E VI Semester (Open Elective) [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC661	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs per Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Analyze Linear Data Structures: Stack, Queues, Lists • Analyze Non Linear Data Structures: Trees • Assess appropriate data structure during program development/Problem Solving 			
Module -1			
INTRODUCTION: Functions and parameters, Dynamic memory allocation, Recursion. LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. L1, L2			
Module -2			
ARRAYS AND MATRICES: Arrays, Matrices, Special matrices, Sparse matrices. STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Paranthesis Matching & Towers of Hanoi. L1, L2, L3			
Module -3			
QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement. HASHING: Dictionaries, Linear representation, Hash table representation. L1, L2, L3			
Module -4			
BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. L1, L2, L3			
Module -5			
Priority Queues: Linear lists, Heaps, Applications-Heap Sorting. Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates. L1, L2, L3			

Course outcomes: After studying this course, students will be able to:

- Acquire knowledge of Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
- Understand non Linear data structures trees and their applications
- Design appropriate data structures for solving computing problems
- Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++**, Sartaj Sahni, Mc. Graw Hill, 2000.
2. **Object Oriented Programming with C++**, E.Balaguruswamy, TMH, 6th Edition, 2013.
3. **Programming in C++**, E.Balaguruswamy. TMH, 4th, 2010.

EMBEDDED CONTROLLER LAB

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL67	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

Course outcomes: After studying this course, students will be able to:

- Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Conduction of Practical Examination:

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

COMPUTER NETWORKS LABORATORY
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL68	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS - 02			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Choose suitable tools to model a network and understand the protocols at various OSI reference levels. • Design a suitable network and simulate using a Network simulator tool. • Simulate the networking concepts and protocols using C/C++ programming. • Model the networks for different configurations and analyze the results. 			
Laboratory Experiments			
PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool			

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
6. Implementation of Link state routing algorithm.

PART-B: Implement the following in C/C++

1. Write a program for a HDLC frame to perform the following.
 - i) Bit stuffing
 - ii) Character stuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.

3. Implement Dijkstra's algorithm to compute the shortest routing path.
4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
 - a. Without error
 - b. With error
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol
6. Write a program for congestion control using leaky bucket algorithm.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Use the network simulator for learning and practice of networking algorithms.
- Illustrate the operations of network protocols and algorithms using C programming.
- Simulate the network with different configurations to measure the performance parameters.
- Implement the data link and routing protocols using C programming.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination one question from software and one question from hardware or only one hardware experiments based on the complexity to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C SEVENTH SEMESTER SYLLABUS

MICROWAVES AND ANTENNAS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	15EC71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none">• Describe the microwave properties and its transmission media• Describe microwave devices for several applications• Understand the basics of antenna theory• Select antennas for specific applications			
Module-1			
Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2) Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) L1, L2			
Module-2			
Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3) Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) L1, L2			
Module-3			
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15) L1, L2, L3			

Module-4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (Text 3: 5.1 – 5.10, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of $\lambda/2$ Antenna. (Text 3: 6.1 – 6.6)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas. (Text 3: 7.1-7.8, 7.19, 7.20)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4th Special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.

DIGITAL IMAGE PROCESSING

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC72	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: The objectives of this course are to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of digital image processing • Understand the image transform used in digital image processing • Understand the image enhancement techniques used in digital image processing • Understand the image restoration techniques and methods used in digital image processing • Understand the Morphological Operations and Segmentation used in digital image processing 			
Module-1			RBT Level
<p>Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. [Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]</p>			L1, L2
Module-2			
<p>Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. [Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10]</p>			L1, L2, L3
Module-3			
<p>Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. [Text: Chapter 5: Sections 5.2, to 5.9]</p>			L1, L2, L3
Module-4			

<p>Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. [Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5]</p>	L1, L2, L3
Module-5	
<p>Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds. Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2]</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course students should be able to:</p> <ul style="list-style-type: none"> • Understand image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of Image Enhancement techniques. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004. 	

POWER ELECTRONICS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

<u>POWER ELECTRONICS</u>			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC73	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none">• Understand the construction and working of various power devices.• Study and analysis of thyristor circuits with different triggering conditions.• Learn the applications of power devices in controlled rectifiers, converters and inverters.• Study of power electronics circuits under various load conditions.			
Module-1			
Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations. (Text 1) L1, L2			
Module-2			
Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation - Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) L1, L2, L3			
Module-3			
Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase controllers with resistive and inductive loads. (Text 1) L1, L2, L3			
Module-4			
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design. (Text 1) L1, L2			
Module-5			
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design. Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state			

relays, Microelectronic relays. (Text 1) **L1, L2**

Course Outcomes: At the end of the course students should be able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 05 marks out of 20 Internal Assessment (IA) Marks, reserved for the other activities.

Text Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

MULTIMEDIA COMMUNICATION

**B.E., VII Semester, Electronics & Communication Engineering/
Telecommunication Engineering**

[As per Choice Based credit System (CBCS) Scheme

Subject Code	15EC741	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours / Module)	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to:

- Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
- Understand digitization principle techniques required to analyze different media types.
- Analyze compression techniques required to compress text and image and gain knowledge of DMS.
- Analyze compression techniques required to compress audio and video.
- Gain fundamental knowledge about multimedia communication across different networks.

REAL TIME SYSTEMS

B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC743	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
Credits – 03			
<p>Course Objectives: This Course will enable students to:</p> <ul style="list-style-type: none"> • Discuss the historical background of Real-time systems and its classifications. • Describe the concepts of computer control and hardware components for Real-Time Application. • Discuss the languages to develop software for Real-Time Applications. • Explain the concepts of operating system and RTS development methodologies. 			
Modules			RBT Level
Module-1			
<p>Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.</p> <p>Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6)</p>			L1, L2
Module-2			
<p>Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8)</p>			L1, L2
Module-3			
<p>Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. (Text Book: 5.1 to 5.14)</p>			L1, L2, L3
Module-4			
<p>Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11)</p>			L1, L2

Module-5	
<p>Design of RTS - General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.</p> <p>RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hatley and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5)</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, students should be able to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of Real time systems and its classifications. • Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications. • Develop the software languages to meet Real time applications. • Apply suitable methodologies to design and develop Real-Time Systems. 	
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. C.M. Krishna, Kang G. Shin, "Real -Time Systems", McGraw -Hill International Editions, 1997. 2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005. 3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005. 	

DSP Algorithms and Architecture
B.E., VII Semester, Electronics & Communication Engineering
/Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC751	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Figure out the knowledge and concepts of digital signal processing techniques. • Understand the computational building blocks of DSP processors and its speed issues. • Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor. • Learn how to interface the external devices to TMS320C54xx processor in various modes. • Understand basic DSP algorithms with their implementation. 			
Module-1			RBT Level
<p>Introduction to Digital Signal Processing: Introduction, A Digital Signal - Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.</p> <p>Computational Accuracy in DSP Implementations: Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation.</p>			L1, L2
Module-2			
<p>Architectures for Programmable Digital Signal - Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.</p>			L1, L2, L3
Module-3			
<p>Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54XX, Memory Space of TMS320C54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On - Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.</p>			L1, L2, L3
Module-4			

<p>Implementation of Basic DSP Algorithms: Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).</p> <p>Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS320C54xx.</p>	L1, L2, L3
Module-5	
<p>Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).</p> <p>Interfacing and Applications of DSP Processors: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.</p>	L1, L2, L3
<p>Course Outcomes: At the end of this course, students would be able to</p> <ul style="list-style-type: none"> • Comprehend the knowledge and concepts of digital signal processing techniques. • Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor. • Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. • Develop basic DSP algorithms using DSP processors. • Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device. • Demonstrate the programming of CODEC interfacing. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of Three sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: “Digital Signal Processing”, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Digital Signal Processing: A practical approach”, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002. 2. “Digital Signal Processors”, B Venkataramani and M Bhaskar, TMH, 2nd, 2010 3. “Architectures for Digital Signal Processing”, Peter Pirsch John Wiley, 2008 	

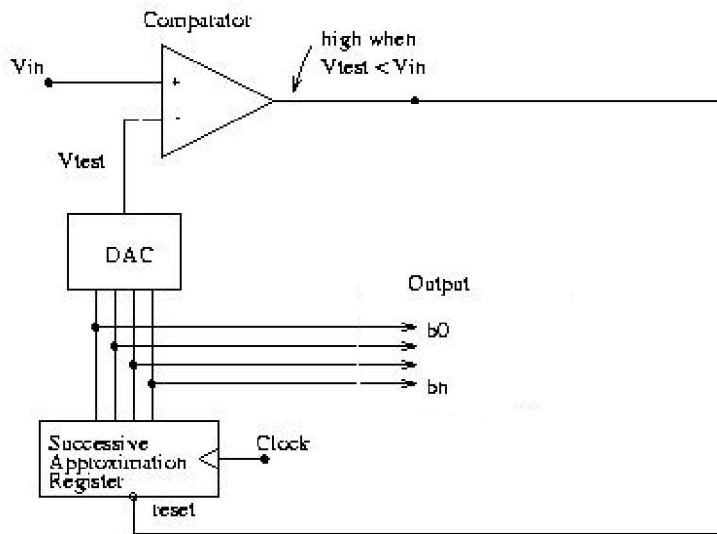
VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL77	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explore the CAD tool and understand the flow of the Full Custom IC design cycle. • Learn DRC, LVS and Parasitic Extraction of the various designs. • Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts. • Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts. 			
<p>Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind</p>			
Laboratory Experiments			
PART - A			
ASIC-DIGITAL DESIGN			
<p>1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.</p> <ol style="list-style-type: none"> i. An inverter ii. A Buffer iii. Transmission Gate iv. Basic/universal gates v. Flip flop -RS, D, JK, MS, T vi. Serial & Parallel adder vii. 4-bit counter [Synchronous and Asynchronous counter] viii. Successive approximation register [SAR] 			

PART - B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.
[Specifications to GDS-II]



* An appropriate constraint should be given.

** Appropriate specification should be given.

*** Applicable Library should be added & information should be given to the Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C EIGHTH SEMESTER SYLLABUS

Wireless Cellular and LTE 4G Broadband

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC81	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the basics of LTE standardization phases and specifications. • Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles. • Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. • Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth. 			
Module - 1			RBT Level
<p>Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).</p> <p>Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 – 2.7 of Text).</p>			L1, L2
Module - 2			
<p>Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 – 3.6 of Text).</p> <p>OFDMA and SC-FDMA: OFDM with FDMA, TDMA, CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 – 4.3, 4.5 of Text).</p> <p>Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 – 5.6 of Text).</p>			L1, L2
Module - 3			
<p>Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink</p>			L1, L2

SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).	
Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text).	
Module - 4	
Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).	L1, L2
Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text).	
Module - 5	
Radio Resource Management and Mobility Management: PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination(Sec 10.1 – 10.5 of Text).	L1, L2
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Understand the system architecture and the functional standard specified in LTE 4G. • Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. • Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. • Test and Evaluate the Performance of resource management and packet data processing and transport algorithms. 	
Question Paper pattern:	
<ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
Text Book:	
Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.	

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
3. 'LTE - The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

FIBER OPTICS and NETWORKS
B.E., VIII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS)]

Subject Code	15EC82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn the basic principle of optical fiber communication with different modes of light propagation. • Understand the transmission characteristics and losses in optical fiber. • Study of optical components and its applications in optical communication networks. • Learn the network standards in optical fiber and understand the network architectures along with its functionalities. 			
Module -1			RBT Level
<p>Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2)</p>			L1, L2
Module -2			
<p>Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p>Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2)</p>			L1, L2
Module -3			
<p>Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.</p> <p>Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.</p> <p>Optical Receiver: Optical Receiver Operation: Error sources,</p>			L1, L2

Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1)	
Module -4	
<p>WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,</p> <p>Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1)</p>	L1, L2
Module -5	
<p>Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropolitan area networks, Access networks, Local area networks. (Text 2)</p>	L1, L2
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Classification and working of optical fiber with different modes of signal propagation. 2. Describe the transmission characteristics and losses in optical fiber communication. 3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers. 4. Describe the constructional features and the characteristics of optical sources and detectors. 5. Illustrate the networking aspects of optical fiber and describe various standards associated with it. 	
<p>Question Paper pattern:</p> <ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gerd Keiser , Optical Fiber Communication, 5th Edition, McGraw Hill 	

Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd
Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Book:

Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005,
ISBN:0130085103

Radar Engineering			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15EC833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the Radar fundamentals and analyze the radar signals. • Understand various technologies involved in the design of radar transmitters and receivers. • Learn various radars like MTI, Doppler and tracking radars and their comparison 			
Modules			RBT Level
Module-1			
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation , Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text)			L1, L2, L3
Module-2			
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)			L1, L2, L3
Module-3			
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)			L1, L2, L3
Module-4			
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse. Sequential Lobing , Conical Scan Tracking, Block Diagram of Conical Scan			L1, L2, L3

Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text)	
Module-5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (Chapter 9: 9.1, 9.2 9.4, 9.5 of Text) Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)	L1, L2, L3
Course outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> • Understand the radar fundamentals and radar signals. • Explain the working principle of pulse Doppler radars, their applications and limitations • Describe the working of various radar transmitters and receivers. • Analyze the range parameters of pulse radar system which affect the system performance 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.	
Reference Books: <ol style="list-style-type: none"> 1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004. 2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998. 3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. Holm. Yesdee, 2013 	

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
III SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 31	Engg. Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Ckts	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10IT– 35	Electronic Instrumentation	@	04		03	25	100	125
10ES – 36	Field Theory	@	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

**SCHEME OF TEACHING & EXAMINATION
ELECTRONICS & COMMUNICATION ENGINEERING
IV SEMESTER (COMMON TO EC/TC/ML)**

Subject Code	Title	Teach Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration	I. A	Theory/ Practical	Total Marks
10MAT - 41	Engg. Mathematics – IV	Mat	04		03	25	100	125
10ES- 42	Microcontrollers	@	04		03	25	100	125
10ES – 43	Control Systems	@	04		03	25	100	125
10EC – 44	Signals & Systems	@	04		03	25	100	125
10EC– 45	Fundamentals of HDL	@	04		03	25	100	125
10EC – 46	Linear ICs & Applications	@	04		03	25	100	125
10ESL – 47	Microcontrollers Lab	@		03	03	25	50	75
10ECL – 48	HDL Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. **ES (for theory) & ECL (for Lab)** in the subject code indicates that the subject is common to electrical and electronics stream consisting of **EE/EC/IT/TC/ML/BM branches** of engineering.

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

V SEMESTER

COMMON TO EC/TE

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	EC	4	-	3	25	100	125
02	10EC52	Digital Signal Processing	EC	4	-	3	25	100	125
03	10EC53	Analog Communication	EC	4	-	3	25	100	125
04	10EC54	Microwaves and Radar	EC	4	-	3	25	100	125
05	10EC55	Information Theory and Coding	EC	4	-	3	25	100	125
06	10EC56	Fundamentals of CMOS VLSI	EC	4	-	3	25	100	125
07	10ECL57	DSP Lab	EC	-	3	3	25	50	75
08	10ECL58	Analog Communication Lab + LIC Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

1

SCHEME OF TEACHING AND EXAMINATION

B.E. ELECTRONICS AND COMMUNICATION

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC61	Digital Communication	EC	4	-	3	25	100	125
2	10EC62	Microprocessors	EC	4	-	3	25	100	125
3	10EC63	Microelectronics Circuits	EC	4	-	3	25	100	125
4	10EC64	Antennas and Propagation	EC	4	-	3	25	100	125
5	10EC65	Operating Systems	EC	4	-	3	25	100	125
6	10EC66x	Elective-I (Group A)	EC	4	-	3	25	100	125
7	10ECL67	Advanced Communication Lab	EC	-	3	3	25	50	75
8	10ECL68	Microprocessor Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-1

10EC665	Data Structures Using C++
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**SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION**

VII Semester

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC71	Computer Communication Networks	EC	4	-	3	25	100	125
2	10EC72	Optical Fiber Communication	EC	4	-	3	25	100	125
3	10EC73	Power Electronics	EC	4	-	3	25	100	125
4	10EC74	Embedded System Design	EC	4	-	3	25	100	125
5	10EC75x	Elective-II (Group B)	EC	4	-	3	25	100	125
6	10EC76x	Elective-III (Group C)	EC	4	-	3	25	100	125
7	10ECL77	VLSI Lab	EC	-	3	3	25	50	75
8	10ECL78	Power Electronics Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-2	
10EC751	DSP Algorithms & Architecture
Elective-3	
10EC762	Real Time Systems

SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EC81	Wireless Communication	EC	4	-	3	25	100	125
2	10EC82	Digital Switching System	EC	4	-	3	25	100	125
3	10EC83x	Elective-IV (Group D)	EC	4	-	3	25	100	125
4	10EC84x	Elective-V (Group E)	EC	4	-	3	25	100	125
5	10ECP85	Project Work	EC	-	6	3	100	100	200
6	10ECS86	Seminar	EC	-	3	-	50	-	50
TOTAL				16	09	15	250	500	750

Elective-4	
10EC833	Optical Networks
Elective-5	
10EC843	GSM

ENGINEERING MATHEMATICS – III

Sub Code	:	10MAT31	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Fourier Series

Periodic functions, Fourier expansions, Half range expansions, Complex form of Fourier series, Practical harmonic analysis.

UNIT 2:

Fourier Transforms

Finite and Infinite Fourier transforms, Fourier sine and cosine transforms, properties. Inverse transforms.

UNIT 3:

Partial Differential Equations (P.D.E)

Formation of P.D.E Solution of non homogeneous P.D.E by direct integration, Solution of homogeneous P.D.E involving derivative with respect to one independent variable only (Both types with given set of conditions) Method of separation of variables. (First and second order equations) Solution of Lagrange's linear P.D.E. of the type $Pp + Qq = R$.

UNIT 4:

Applications of P.D.E

Derivation of one dimensional wave and heat equations. Various possible solutions of these by the method of separation of variables. D'Alembert's solution of wave equation. Two dimensional Laplace's equation – various possible solutions. Solution of all these equations with specified boundary conditions. (Boundary value problems).

UNIT 5:

Numerical Methods

Introduction, Numerical solutions of algebraic and transcendental equations:- Newton-Raphson and Regula-Falsi methods. Solution of linear simultaneous equations : - Gauss elimination and Gauss Jordan methods. Gauss - Seidel

iterative method. Definition of eigen values and eigen vectors of a square matrix. Computation of largest eigen value and the corresponding eigen vector by Rayleigh's power method.

UNIT 6:

Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences – Newton's divided difference formula. Lagrange's interpolation and inverse interpolation formulae. Numerical differentiation using Newton's forward and backward interpolation formulae. Numerical Integration – Simpson's one third and three eighth's value, Weddle's rule.
(All formulae / rules without proof).

UNIT 7:

Calculus of Variations

Variation of a function and a functional Extremal of a functional, Variational problems, Euler's equation, Standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

UNIT 8:

Difference Equations and Z-transforms

Difference equations – Basic definitions. Z-transforms – Definition, Standard Z-transforms, Linearity property, Damping rule, Shifting rule, Initial value theorem, Final value theorem, Inverse Z-transforms. Application of Z-transforms to solve difference equations.

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

ANALOG ELECTRONIC CIRCUITS

(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES32	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Diode Circuits: Diode Resistance, Diode equivalent circuits, Transition and diffusion capacitance, Reverse recovery time, Load line analysis, Rectifiers, Clippers and clampers.

UNIT 2:

Transistor Biasing: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased, DC bias with voltage feedback, Miscellaneous bias configurations, Design operations, Transistor switching networks, PNP transistors, Bias stabilization.

UNIT 3:

Transistor at Low Frequencies: BJT transistor modeling, CE Fixed bias configuration, Voltage divider bias, Emitter follower, CB configuration, Collector feedback configuration, Analysis of circuits r_c model; analysis of CE configuration using h- parameter model; Relationship between h- parameter model of CE, CC and CE configuration.

UNIT 4:

Transistor Frequency Response: General frequency considerations, low frequency response, Miller effect capacitance, High frequency response, multistage frequency effects.

UNIT 5:

(a) General Amplifiers: Cascade connections, Cascode connections, Darlington connections.

(b) Feedback Amplifier: Feedback concept, Feedback connections type, Practical feedback circuits. Design procedures for the feedback amplifiers.

UNIT 6:

Power Amplifiers: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions. Designing of Power amplifiers.

UNIT 7:

Oscillators: Oscillator operation, Phase shift Oscillator, Wienbridge Oscillator, Tuned Oscillator circuits, Crystal Oscillator. (BJT Version Only)
Simple design methods of Oscillators.

UNIT 8:

FET Amplifiers: FET small signal model, Biasing of FET, Common drain common gate configurations, MOSFETs, FET amplifier networks.

TEXT BOOK:

1. “**Electronic Devices and Circuit Theory**”, Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 9TH Edition.

REFERENCE BOOKS:

1. ‘**Integrated Electronics**’, Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2nd Edition, 2010
2. “**Electronic Devices and Circuits**”, David A. Bell, PHI, 4th Edition, 2004
3. “**Analog Electronics Circuits: A Simplified Approach**”, U.B. Mahadevaswamy, Pearson/Saguine, 2007.

LOGIC DESIGN
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES33	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Principles of combinational logic-1: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations.

UNIT 2:

Principles of combinational Logic-2: Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables, Map entered variables.

UNIT 3:

Analysis and design of combinational logic - I: General approach, Decoders-BCD decoders, Encoders.

UNIT 4:

Analysis and design of combinational logic - II: Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.

UNIT 5:

Sequential Circuits – 1: Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The \overline{S} \overline{R} Latch, The gated SR Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.

UNIT 6:

Sequential Circuits – 2: Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops

UNIT 7:

Sequential Design - I: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design.

UNIT 8:

Sequential Design - II: Construction of state Diagrams, Counter Design.

TEXT BOOKS:

1. “**Digital Logic Applications and Design**”, John M Yarbrough, Thomson Learning, 2001.
2. “**Digital Principles and Design**“, Donald D Givone, Tata McGraw Hill Edition, 2002.

REFERENCE BOOKS:

1. “**Fundamentals of logic design**”, Charles H Roth, Jr; Thomson Learning, 2004.
2. “**Logic and computer design Fundamentals**”, Mono and Kim, Pearson, Second edition, 2001.
3. “**Logic Design**”, Sudhakar Samuel, Pearson/Saguine, 2007

NETWORK ANALYSIS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES34	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis With linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

UNIT 2:

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

UNIT 3:

Network Theorems – 1: Superposition, Reciprocity and Millman’s theorems.

UNIT 4:

Network Theorems - II:

Thevenin's and Norton's theorems; Maximum Power transfer theorem

UNIT 5: Resonant Circuits: Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

UNIT 6:

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

UNIT 7:

Laplace Transformation & Applications : Solution of networks, step, ramp and impulse responses, waveform Synthesis

UNIT 8:

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets.

TEXT BOOKS:

1. “**Network Analysis**”, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002.
2. “**Networks and systems**”, Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.

REFERENCE BOOKS:

1. “**Engineering Circuit Analysis**”, Hayt, Kemmerly and DurbinTMH 7th Edition, 2010
2. “**Basic Engineering Circuit Analysis**”, J. David Irwin / R. Mark Nelms, John Wiley, 8th ed, 2006.
3. “**Fundamentals of Electric Circuits**”, Charles K Alexander and Mathew N O Sadiku, Tata McGraw-Hill, 3 ed, 2009.

ELECTRONIC INSTRUMENTATION
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10IT35	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT – 1:

Introduction

(a) Measurement Errors: Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures.

(b) Voltmeters and Multimeters Introduction, Multirange voltmeter, Extending voltmeter ranges, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters.

UNIT – 2:

Digital Instruments

Digital Voltmeters – Introduction, DVM's based on $V - T$, $V - F$ and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time.

UNIT – 3:

Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch.

UNIT – 4:

Special Oscilloscopes

Delayed time-base oscilloscopes, Analog storage, Sampling and Digital storage oscilloscopes.

UNIT – 5:

Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator, Frequency synthesizer.

UNIT – 6:

Measurement of resistance, inductance and capacitance

Whetstone's bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell's bridge, Wein's bridge, Wagner's earth connection

UNIT – 7:

Transducers - I

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers and LVDT.

UNIT – 8:

Miscellaneous Topics

(a) Transducers - II –Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo devices, Temperature transducers-RTD, Thermocouple .

(b) Display devices: Digital display system, classification of display, Display devices, LEDs, LCD displays.

(c) Bolometer and RF power measurement using Bolometer

(d) Introduction to Signal conditioning.

(e) Introduction to LabView.

TEXT BOOKS:

1. **“Electronic Instrumentation”**, H. S. Kalsi, TMH, 3rd 2010
2. **“Electronic Instrumentation and Measurements”**, David A Bell, PHI / Pearson Education, 2006.

REFERENCE BOOKS:

1. **“Principles of measurement systems”**, John P. Beatly, 3rd Edition, Pearson Education, 2000
2. **“Modern electronic instrumentation and measuring techniques”**, Cooper D & A D Helfrick, PHI, 1998.
3. **Electronics & electrical measurements**, A K Sawhney, , Dhanpat Rai & sons, 9th edition.

FIELD THEORY
(Common to EC/TC/ML/EE)

Sub Code	:	10ES36	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge.

b. Electric flux density, Gauss' law and divergence: Electric flux density, Gauss' law, Divergence, Maxwell's First equation(Electrostatics), vector operator ∇ and divergence theorem.

UNIT 2:

a. Energy and potential : Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient , Energy density in an electrostatic field.

b. Conductors, dielectrics and capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, capacitance and examples.

UNIT 3:

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations.

UNIT 4:

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.

UNIT 5:

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

UNIT 6:

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

UNIT 7:

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect).

UNIT 8:

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions.

TEXT BOOK:

1. **“Engineering Electromagnetics”**, William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2006

REFERENCE BOOKS:

1. **“Electromagnetics with Applications”**, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999
2. **“Electromagnetic Waves And Radiating Systems,”** Edward C. Jordan and Keith G Balmain, Prentice – Hall of India / Pearson Education, 2nd edition, 1968.Reprint 2002
3. **“Field and Wave Electromagnetics”**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

ANALOG ELECTRONICS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL37	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use the Discrete components to test the circuits. LabView can be used for the verification and testing along with the above.

1. Wiring of RC coupled Single stage FET & BJT amplifier and determination of the gain-frequency response, input and output impedances.
2. Wiring of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances (Single circuit) (One Experiment)
3. Wiring of a two stage BJT Voltage series feed back amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback (One Experiment)
4. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for $f_0 \leq 10$ KHz
5. Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range $f_0 \geq 100$ KHz.
6. Testing for the performance of BJT -Crystal Oscillator for $f_0 > 100$ KHz
- 7 Testing of Diode clipping (Single/Double ended) circuits for peak clipping, peak detection
8. Testing of Clamping circuits: positive clamping /negative clamping.
9. Testing of a transformer less Class – B push pull power amplifier and determination of its conversion efficiency.
10. Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency

11. Verification of Thevinin's Theorem and Maximum Power Transfer theorem for DC Circuits.

12. Characteristics of Series and Parallel resonant circuits.

LOGIC DESIGN LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ESL38	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:		Exam Marks	:	50

NOTE: Use discrete components to test and verify the logic gates. LabView can be used for designing the gates along with the above.

1. Simplification, realization of Boolean expressions using logic gates/Universal gates.
2. Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3. (i) Realization of parallel adder/Subtractors using 7483 chip
(ii) BCD to Excess-3 code conversion and vice versa.
4. Realization of Binary to Gray code conversion and vice versa
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.
6. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display and b) Priority encoder.
8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.
9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).
10. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.
11. Wiring and testing Ring counter/Johnson counter.
12. Wiring and testing of Sequence generator.

ENGINEERING MATHEMATICS - IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Numerical Methods

Numerical solutions of first order and first degree ordinary differential equations – Taylor’s series method, Modified Euler’s method, Runge – Kutta method of fourth order, Milne’s and Adams-Bashforth predictor and corrector methods (All formulae without Proof).

UNIT 2:

Complex Variables

Function of a complex variable, Limit, Continuity Differentiability – Definitions. Analytic functions, Cauchy – Riemann equations in cartesian and polar forms, Properties of analytic functions. Conformal Transformation – Definition. Discussion of transformations: $W = z^2$, $W = e^z$, $W = z + (1/z)$, $z \neq 0$ Bilinear transformations.

UNIT 3:

Complex Integration

Complex line integrals, Cauchy’s theorem, Cauchy’s integral formula. Taylor’s and Laurent’s series (Statements only) Singularities, Poles, Residues, Cauchy’s residue theorem (statement only).

UNIT 4:

Series solution of Ordinary Differential Equations and Special Functions

Series solution – Frobenius method, Series solution of Bessel’s D.E. leading to Bessel function of first kind. Equations reducible to Bessel’s D.E., Series solution of Legendre’s D.E. leading to Legendre Polynomials. Rodrigue’s formula.

UNIT 5:

Statistical Methods

Curve fitting by the method of least squares: $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$, $y = ab^x$, $y = ae^{bx}$, Correlation and Regression.

Probability: Addition rule, Conditional probability, Multiplication rule, Baye's theorem.

UNIT 6:

Random Variables (Discrete and Continuous) p.d.f., c.d.f. Binomial, Poisson, Normal and Exponential distributions.

UNIT 7:

Sampling, Sampling distribution, Standard error. Testing of hypothesis for means. Confidence limits for means, Student's t distribution, Chi-square distribution as a test of goodness of fit.

UNIT 8:

Concept of joint probability – Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient.

Probability vectors, Stochastic matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.

Text book:

1. **Higher Engineering Mathematics** by Dr. B.S. Grewal, 36th Edn. Kanna Publications.
2. **Probability** by Seymour Lipschutz (Schaum's series)

Reference Books:

1. **Higher Engineering Mathematics** by B.V. Ramana (Tata-Macgraw Hill).
2. **Advanced Modern Engineering Mathematics** by Glyn James – Pearson Education.

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MICROCONTROLLERS
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES42	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

UNIT 2:

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

UNIT 3:

8051 programming: Assembler directives, Assembly language programs and Time delay calculations.

UNIT 4:

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming

UNIT 5:

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .

UNIT 6:

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

Course Aim – The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultra-low power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

UNIT 7:

Motivation for MSP430 microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design).

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

Introduction to Code Composer Studio (CCS v4). Understanding how to use CCS for Assembly, C, Assembly+C projects for MSP430 microcontrollers. Interrupt programming.

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins.

UNIT 8:

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA.

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low-power programming and Interrupt.

Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces.

TEXT BOOKS:

1. “**The 8051 Microcontroller and Embedded Systems – using assembly and C**”-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006
2. “**MSP430 Microcontroller Basics**”, John Davies, Elsevier, 2008.

REFERENCE BOOKS:

1. “**The 8051 Microcontroller Architecture, Programming & Applications**”, 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.
2. “**The 8051 Microcontroller**”, V.Udayashankar and MalikarjunaSwamy, TMH, 2009
3. **MSP430 Teaching CD-ROM**, Texas Instruments, 2008 (can be requested <http://www.uniti.in>)
4. **Microcontrollers: Architecture, Programming, Interfacing and System Design**”,Raj Kamal, “Pearson Education, 2005

CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Sub Code	:	10ES43	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Modeling of Systems: Introduction to Control Systems, Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical systems, Friction, Translational systems (Mechanical accelerometer, systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded),

UNIT 3:

Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. Introduction to PID Controllers(excluding design)

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh- stability criterion, Relative stability analysis; More on the Routh stability criterion.

UNIT 5:

Root–Locus Techniques: Introduction, The root locus concepts, Construction of root loci.

UNIT 6:

Frequency domain analysis: Correlation between time and frequency response, Bode plots, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. Introduction to lead, lag and lead-lag compensating networks (excluding design).

UNIT 7:

Stability in the frequency domain: Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded).

UNIT 8:

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations.

TEXT BOOK :

1. J. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, Fourth edition – 2005

REFERENCE BOOKS:

1. **“Modern Control Engineering “**, K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002.
2. **“Automatic Control Systems”**, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. **“Feedback and Control System”**, Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007.

SIGNALS & SYSTEMS
(Common to EC/TC/IT/BM/ML)

Sub Code	: 10EC44	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT 2:

Time-domain representations for LTI systems – 1: Convolution, impulse response representation, Convolution Sum and Convolution Integral.

UNIT 3:

Time-domain representations for LTI systems – 2: Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT 4:

Fourier representation for signals – 1: Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties .

UNIT 5:

Fourier representation for signals – 2: Discrete and continuous Fourier transforms(derivations of transforms are excluded) and their properties.

UNIT 6:

Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling theorem and Nyquist rate.

UNIT 7:

Z-Transforms – 1: Introduction, Z – transform, properties of ROC, properties of Z – transforms, inversion of Z – transforms.

UNIT 8:

Z-transforms – 2: Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations.

TEXT BOOK

1. **Simon Haykin**, “Signals and Systems”, John Wiley India Pvt. Ltd., 2nd Edn, 2008.
2. **Michael Roberts**, “Fundamentals of Signals & Systems”, 2nd ed, Tata McGraw-Hill, 2010

REFERENCE BOOKS:

1. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, “Signals and Systems” Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
2. **H. P Hsu, R. Ranjan**, “Signals and Systems”, Scham’s outlines, TMH, 2006
3. **B. P. Lathi**, “Linear Systems and Signals”, Oxford University Press, 2005
4. **Ganesh Rao and Satish Tunga**, “Signals and Systems”, Pearson/Sanguine Technical Publishers, 2004

**FUNDAMENTALS OF HDL
(Common to EC/TC/IT/BM/ML)**

Sub Code	: 10EC45	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction: Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

UNIT 2:

Data –Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors.

UNIT 3:

Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements.

UNIT 4:

Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

UNIT 5: Procedures, Tasks, and Functions: Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions.

Advanced HDL Descriptions: File Processing, Examples of File Processing

UNIT 6:

Mixed –Type Descriptions: Why Mixed-Type Description? VHDL User-Defined Types, VHDL Packages, Mixed-Type Description examples

UNIT 7:

Mixed –Language Descriptions: Highlights of Mixed-Language Description, How to invoke One language from the Other, Mixed-language Description Examples, Limitations of Mixed-Language Description.

UNIT 8:

Synthesis Basics: Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain.

TEXT BOOKS:

1. **HDL Programming (VHDL and Verilog)**- Nazeih M.Botros- John Wiley India Pvt. Ltd. 2008.

REFERENCE BOOKS:

1. **Fundamentals of HDL** – Cyril P.R. Pearson/Sanguin 2010.
2. **VHDL** –Douglas perry-Tata McGraw-Hill
3. **A Verilog HDL Primer**- J.Bhaskar – BS Publications
4. **Circuit Design with VHDL**-Volnei A.Pedroni-PHI

LINEAR IC's & APPLICATIONS
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10EC46	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

UNIT 1:

Operational Amplifier Fundamentals: Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Op-Amps as DC Amplifiers- Biasing Op-Amps, Direct coupled -Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.

UNIT 2:

Op-Amps as AC Amplifiers: Capacitor coupled Voltage Follower, High input impedance - Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, High input impedance - Capacitor coupled Non-inverting Amplifiers, Capacitor coupled Inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled Difference amplifier, Use of a single polarity power supply.

UNIT 3:

Op-Amps frequency response and compensation: Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions.

UNIT 4:

OP-AMP Applications: Voltage sources, current sources and current sinks, Current amplifiers, instrumentation amplifier, precision rectifiers, Limiting circuits.

UNIT 5:

More applications: Clamping circuits, Peak detectors, sample and hold circuits, V to I and I to V converters, Log and antilog amplifiers, Multiplier and divider, Triangular / rectangular wave generators, Wave form generator design, phase shift oscillator, Wein bridge oscillator.

UNIT 6:

Non-linear circuit applications: crossing detectors, inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Active Filters –First and second order Low pass & High pass filters.

UNIT 7:

Voltage Regulators: Introduction, Series Op-Amp regulator, IC Voltage regulators, 723 general purpose regulator, Switching regulator.

UNIT 8:

Other Linear IC applications: 555 timer - Basic timer circuit, 555 timer used as astable and monostable multivibrator, Schmitt trigger; PLL-operating principles, Phase detector / comparator, VCO; D/A and A/ D converters – Basic DAC Techniques, AD converters.

TEXT BOOKS:

1. **“Operational Amplifiers and Linear IC’s”**, David A. Bell, 2nd edition, PHI/Pearson, 2004
2. **“Linear Integrated Circuits”**, D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International

REFERENCE BOOKS:

1. **“Opamps- Design, Applications and Trouble Shooting”**, Terrell, Elsevier, 3rd ed. 2006.
2. **“Operational Amplifiers”**, George Clayton and Steve Winder, Elsever
5th ed., 2008

3. “Operational Amplifiers and Linear Integrated Circuits”, Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson, 2006
4. “Design with Operational Amplifiers and Analog Integrated Circuits”, Sergio Franco, TMH, 3e, 2005

MICROCONTROLLERS LAB
(Common to EC/TC/EE/IT/BM/ML)

Sub Code	: 10ESL47	IA Marks	: 25
Hrs/ Week	: 03	Exam Hours	: 03
Total Hrs.	: 42	Exam Marks	: 50

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430.

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

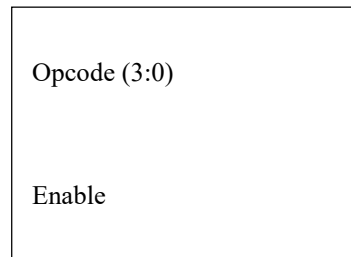
HDL LAB
(Common to EC/TC/IT/BM/ML)

Sub Code	:	10ECL48	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/AceX/Max/Spartan/Sinfi/TK Base or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

PROGRAMMING (using VHDL /Verilog)

1. Write HDL code to realize all the logic gates
2. Write a HDL program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
2. Write a HDL code to describe the functions of a Full Adder Using three modeling styles.
3. Write a model for 32 bit ALU using the schematic diagram shown below
A (31:0) B (31:0)



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line is high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the given in example below.

OPCODE	ALU OPERATION
1.	A + B
2.	A – B
3.	A Complement
4.	A * B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

4. Develop the HDL code for the following flip-flops, SR, D, JK, T.
5. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters

INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on the given seven segment display and LCD and accepting Hex key pad input data.
2. Write HDL code to control speed, direction of DC and Stepper motor.
3. Write HDL code to accept 8 channel Analog signal, Temperature sensors and display the data on LCD panel or Seven segment display.
4. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.
5. Write HDL code to simulate Elevator operations
- 6.** Write HDL code to control external lights using relays.

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of Management - Management as a Science, Art or Profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-Early Management Approaches-Modern Management Approaches.

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

UNIT - 3

ORGANISING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees – Centralisation Vs Decentralisation of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship - Evolution of

Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI - Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

TEXT BOOKS:

1. **Principles of Management** - P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th Edition, 2010
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House.
3. **Entrepreneurship Development** - Small Business Enterprises - Poornima M Charantimath - Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development Robert Lusier – Thomson.
2. **Entrepreneurship Development** - S S Khanka - S Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education /PHI -17th Edition, 2003.

DIGITAL SIGNAL PROCESSING

Subject Code	: 10EC52	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.

UNIT - 2

Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties.

UNIT - 3

Use of DFT in linear filtering, overlap-save and overlap-add method. Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).

UNIT - 4

Radix-2 FFT algorithm for the computation of DFT and IDFT—decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform

UNIT - 5

IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations.

UNIT - 6

Implementation of discrete-time systems: Structures for IIR and FIR systems- direct form I and direct form II systems, cascade, lattice and parallel realization.

UNIT - 7

FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlett and Kaiser windows, FIR filter design using frequency sampling technique.

UNIT - 8

Design of IIR filters from analog filters (Butterworth and Chebyshev) - impulse invariance method. Mapping of transfer functions: Approximation of derivative (backward difference and bilinear transformation) method, Matched z transforms, Verification for stability and linearity during mapping

TEXT BOOK:

1. **Digital signal processing – Principles Algorithms & Applications**, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

REFERENCE BOOKS:

1. **Discrete Time Signal Processing**, Oppenheim & Schaffer, PHI, 2003.
2. **Digital Signal Processing**, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. **Digital Signal Processing**, Lee Tan: Elsvier publications, 2007

ANALOG COMMUNICATION

Subject Code	: 10EC53	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

RANDOM PROCESS: Random variables: Several random variables. Statistical averages: Function of Random variables, moments, Mean, Correlation and Covariance function: Principles of autocorrelation function, cross – correlation functions. Central limit theorem, Properties of Gaussian process.

UNIT - 2

AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

UNIT - 3

SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals, Single side-band modulation, Frequency-Domain description of SSB wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave, Time-Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves.

UNIT - 4

VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time - Domain description, Envelop detection of VSB wave plus carrier, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

UNIT - 5

ANGLE MODULATION (FM)-I: Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

UNIT - 6

ANGLE MODULATION (FM)-II: Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems.

UNIT - 7

NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth, Noise Figure, Equivalent noise temperature, cascade connection of two-port networks.

UNIT - 8

NOISE IN CONTINUOUS WAVE MODULATION SYSTEMS: Introduction, Receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM,.

TEXT BOOKS:

1. **Communication Systems**, Simon Haykins, 5th Edition, John Wiley, India Pvt. Ltd, 2009.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008

REFERENCE BOOKS:

1. **Modern digital and analog Communication systems** B. P. Lathi, Oxford University Press., 4th ed, 2010,
2. **Communication Systems**, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. **Communication Systems: Singh and Sapre: Analog and digital** TMH 2nd , Ed 2007.

MICROWAVES AND RADAR

Subject Code	: 10EC54	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MICROWAVE TRANSMISSION LINES: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors.

UNIT - 2

MICROWAVE WAVEGUIDES AND COMPONENTS: Introduction, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators.

UNIT - 3

MICROWAVE DIODES,

Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers
Other diodes: PIN diodes, Schottky barrier diodes.

UNIT - 4

Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi port networks.

UNIT - 5

Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees.

UNIT - 6

STRIP LINES: Introduction, Microstrip lines, Parallèle strip lines, Coplanar strip lines, Shielded strip Lines.

UNIT - 7

AN INTRODUCTION TO RADAR: Basic Radar, The simple form of the Radar equation, Radar block diagram, Radar frequencies, application of Radar, the origins of Radar.

UNIT - 8

MTI AND PULSE DOPPLER RADAR: Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, pulse Doppler Radar.

TEXT BOOKS:

1. **Microwave Devices and circuits-** Liao / Pearson Education.
2. **Introduction to Radar systems-**Merrill I Skolnik, 3rd Ed, TMH, 2001.
3. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.

REFERENCE BOOK:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2008.

INFORMATION THEORY AND CODING

Subject Code	: 10EC55	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INFORMATION THEORY: Introduction, Measure of information, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences. Mark-off statistical model for information source, Entropy and information rate of mark-off source.

UNIT - 2

SOURCE CODING: Encoding of the source output, Shannon's encoding algorithm. Communication Channels, Discrete communication channels, Continuous channels.

UNIT - 3

FUNDAMENTAL LIMITS ON PERFORMANCE: Source coding theorem, Huffman coding, Discrete memory less Channels, Mutual information, Channel Capacity.

UNIT - 4

Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem.

UNIT - 5

INTRODUCTION TO ERROR CONTROL CODING: Introduction, Types of errors, examples, Types of codes Linear Block Codes: Matrix description, Error detection and correction, Standard arrays and table look up for decoding.

UNIT - 6

Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

UNIT - 7

RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes.

UNIT - 8

Convolution Codes, Time domain approach. Transform domain approa

TEXT BOOKS:

1. **Digital and analog communication systems**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. **Digital communication**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **ITC and Cryptography**, Ranjan Bose, TMH, II edition, 2007
2. **Digital Communications** - Glover and Grant; Pearson Ed. 2nd Ed 2008.
- 3.

FUNDAMENTALS OF CMOS VLSI

Subject Code	: 10EC56	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

BASIC MOS TECHNOLOGY: Integrated circuit's era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. BiCMOS technology. Production of E-beam masks.

MOS TRANSISTOR THEORY: Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter.

UNIT - 2

CIRCUIT DESIGN PROCESSES: MOS layers. Stick diagrams. Design rules and layout – lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Tutorial exercises.

Basic Physical Design of Simple logic gates.

UNIT - 3

CMOS LOGIC STRUCTURES: CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch Logic (CVSL).

UNIT - 4

BASIC CIRCUIT CONCEPTS: Sheet resistance. Area capacitances. Capacitance calculations. The delay unit. Inverter delays. Driving capacitive loads. Propagation delays. Wiring capacitances.

SCALING OF MOS CIRCUITS: Scaling models and factors. Limits on scaling. Limits due to current density and noise.

UNIT - 5

CMOS SUBSYSTEM DESIGN: Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations.

Clocking Strategies

UNIT - 6

CMOS SUBSYSTEM DESIGN PROCESSES: General considerations. Process illustration. ALU subsystem. Adders. Multipliers.

UNIT - 7

MEMORY, REGISTERS AND CLOCK: Timing considerations. Memory elements. Memory cell arrays.

UNIT - 8

TESTABILITY: Performance parameters. Layout issues. I/O pads. Real estate. System delays. Ground rules for design. Test and testability.

TEXT BOOKS:

1. **CMOS VLSI Design – A Circuits and Systems Perspective. 3rd Edition.** N.H. Weste and David Harris. Addison-Wesley, 2005. (Refer to <http://www.cmosvlsi.com>)
2. **Principles of CMOS VLSI Design: A Systems Perspective,** Neil H. E. Weste, K. Eshragian, and ??? 3rd edition, Pearson Education (Asia) Pvt. Ltd., 200?. (Shift to the latest edition.)
3. **Basic VLSI Design -** Douglas A. Pucknell & Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994), 2005.

REFERENCE BOOKS:

1. R. Jacob Baker. CMOS Circuit Design, Layout and Simulation. John Wiley India Pvt. Ltd, 2008
2. **Fundamentals of Semiconductor Devices,** M. K. Achuthan and K. N. Bhat, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. **CMOS Digital Integrated Circuits: Analysis and Design,** Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
4. **Analysis and Design of Digital Integrated Circuits -** D.A Hodges, H.G Jackson and R.A Saleh. 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

DIGITAL SIGNAL PROCESSING LABORATORY

Subject Code	: 10ECL57	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

A LIST OF EXPERIMENTS USING MATLAB / SCILAB / OCTAVE / WAB

1. Verification of Sampling theorem.
2. Impulse response of a given system
3. Linear convolution of two given sequences.
4. Circular convolution of two given sequences
5. Autocorrelation of a given sequence and verification of its properties.
6. Cross correlation of given sequences and verification of its properties.
7. Solving a given difference equation.
8. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
9. Linear convolution of two sequences using DFT and IDFT.
10. Circular convolution of two given sequences using DFT and IDFT
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications.

B. LIST OF EXPERIMENTS USING DSP PROCESSOR

1. Linear convolution of two given sequences.
2. Circular convolution of two given sequences.
3. Computation of N- Point DFT of a given sequence
4. Realization of an FIR filter (any type) to meet given specifications .The input can be a signal from function generator / speech signal.
5. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms
6. Noise: Add noise above 3kHz and then remove; Interference suppression using 400 Hz tone.
7. Impulse response of first order and second order system

REFERENCE BOOKS:

1. **Digital signal processing using MATLAB** - Sanjeet Mitra, TMH, 2001
2. **Digital signal processing using MATLAB** - J. G. Proakis & Ingale, MGH, 2000
3. **Digital Signal Processors**, B. Venkataramani and Bhaskar, TMH, 2002

ANALOG COMMUNICATION LAB + LIC LAB

Subject Code	: 10ECL58	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

**EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW
- 2009 CAN BE USED FOR VERIFICATION AND TESTING.**

1. Second order active LPF and HPF
2. Second order active BPF and BE
3. Schmitt Trigger Design and test a Schmitt trigger circuit for the given values of UTP and LTP
4. Frequency synthesis using PLL.
5. Design and test R-2R DAC using op-amp
6. Design and test the following circuits using IC 555
 - a. Astable multivibrator for given frequency and duty cycle
 - b. Monostable multivibrator for given pulse width W
7. IF amplifier design
8. Amplitude modulation using transistor/FET (Generation and detection)
9. Pulse amplitude modulation and detection
10. PWM and PPM
11. Frequency modulation using 8038/2206
12. Precision rectifiers – both Full Wave and Half Wave.

VI SEMESTER

DIGITAL COMMUNICATION

Subject Code	: 10EC61	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery.

UNIT - 2

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, robust quantization.

UNIT - 3

DPCM, DM, applications. Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals.

UNIT - 4

ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

UNIT - 5

DIGITAL MODULATION TECHNIQUES: Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques. Non-coherent binary modulation techniques.

UNIT - 6

Detection and estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

UNIT - 7

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

UNIT - 8

Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency

hop spread spectrum, applications.

TEXT BOOK:

1. **Digital communications**, Simon Haykin, John Wiley India Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. **Digital and Analog communication systems**, Simon Haykin, John Wiley India Pvt. Ltd, 2008
2. **An introduction to Analog and Digital Communication**, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 2008.
3. **Digital communications** - Bernard Sklar: Pearson education 2007

MICROPROCESSOR

Subject Code	: 10EC62	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing, The 8086

UNIT - 2

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators

UNIT - 3

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display

UNIT - 4

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples

UNIT - 5

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor

UNIT - 6

8086 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples

UNIT - 7

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), the universal serial bus (USB)

UNIT - 8

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.

TEXT BOOKS:

1. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and G. A. Gibson, 2E PHI -2003
2. **The Intel Microprocessor, Architecture, Programming and Interfacing**-Barry B. Brey, 6e, Pearson Education / PHI, 2003

REFERENCE BOOKS:

1. **Microprocessor and Interfacing- Programming & Hardware**, Douglas hall, 2nd, TMH, 2006.
2. **Advanced Microprocessors and Peripherals** - A.K. Ray and K.M. Bhurchandi, TMH, 2nd, 2006.
3. **8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware & Applications** - Triebel and Avtar Singh, 4e, Pearson Education, 2003

MICROELECTRONICS CIRCUITS

Subject Code : **10EC63**

No. of Lecture Hrs/Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 25

Exam Hours : 03

Exam Marks : 100

UNIT – 1

MOSFETS: Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation modes, single stage MOS amplifiers. MOSFET internal capacitances and high frequency modes, Frequency response of CS amplifiers, CMOS digital logic inverter, detection type MOSFET.

UNIT -2

Single Stage IC Amplifier: IC Design philosophy, Comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response.

UNIT – 3

Single Stage IC amplifiers (continued): CS and CF amplifiers with loads, high frequency response of CS and CF amplifiers, CG and CB amplifiers with active loads, high frequency response of CG and CB amplifiers, Cascade amplifiers. CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance. SPICE examples.

UNIT – 4

Differences and Multistage Amplifiers: The MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers. Multistage amplifier. SPICE examples.

UNIT – 5

Feedback. General Feedback structure. Properties of negative feedback. Four basic feedback topologies. Series-Shunt feedback. Determining the loop gain. Stability problem. Effect of feedback an amplifier poles. Stability study using Bode plots. Frequency compensation. SPICE examples.

UNIT - 6

Operational Amplifiers: The two stage CMOS Op-amp, folded cascade CMOS op-amp, 741 op-amp circuit, DC analysis of the 741, small signal analysis of 741, gain, frequency response and slew rate of 741. Data Converters. A-D and D-A converters.

UNIT – 7 & 8

Digital CMOS circuits. Overview. Design and performance analysis of CMOS inverter. Logic Gate Circuits. Pass-transistor logic. Dynamic Logic Circuits. SPICE examples.

Text Book:

1. “**Microelectronic Circuits**”, Adel Sedra and K.C. Smith, 5th Edition, Oxford University Press, Interantional Version, 2009.

Reference Book:

1. “**Fundamentals of Microelectronics**”, Behzad Razavi, John Wiley India Pvt. Ltd, 2008.
2. “**Microelectronics – Analysis and Design**”, Sundaram Natarajan, Tata McGraw-Hill, 2007

ANTENNAS AND PROPAGATION

Subject Code	: 10EC64	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, antenna apertures, effective height, bandwidth, radiation, efficiency, antenna temperature and antenna filed zones.

UNIT - 2

POINT SOURCES AND ARRAYS: Introduction, point sources, power patterns, power theorem, radiation intensity, filed patterns, phase patterns. Array of two isotropic point sources. Endfire array and Broadside array.

UNIT - 3

ELECTRIC DIPOLES AND THIN LINEAR ANTENNAS: Introduction, short electric dipole, fields of a short dipole(no derivation of field components), radiation resistance of short dipole, radiation resistances of $\lambda/2$ Antenna, thin linear antenna, micro strip arrays, low side lobe arrays, long wire antenna, folded dipole antennas.

UNIT - 4 & 5

LOOP, SLOT, PATCH AND HORN ANTENNA: Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop, radiation resistance, directivity, slot antenna, Babinet’s principle and complementary antennas,

impedance of complementary and slot antennas, patch antennas, horn antennas, rectangular horn antennas.

UNIT - 6

ANTENNA TYPES: Helical Antenna, Yagi-Uda array, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna, high-resolution data, intelligent antennas, antenna for remote sensing.

UNIT - 7 & 8

RADIO WAVE PROPAGATION: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction.

TROPOSPHERE WAVE PROPAGATION: Troposcopic scatter, Ionosphere propagation, electrical properties of the ionosphere, effects of earth's magnetic field.

TEXT BOOKS:

1. **Antennas and Wave Propagation**, John D. Krauss, 4th Edn, McGraw-Hill International edition, 2010.
2. **Antennas and Wave Propagation** - Harish and Sachidananda: Oxford Press 2007

REFERENCE BOOKS:

1. **Antenna Theory Analysis and Design** - C A Balanis, 3rd Edn, John Wiley India Pvt. Ltd, 2008
2. **Antennas and Propagation for Wireless Communication Systems** - Sineon R Saunders, John Wiley, 2003.
3. **Antennas and wave propagation** - G S N Raju: Pearson Education 2005

OPERATING SYSTEMS

Subject Code	: 10EC65	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS:

Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating

systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems.

UNIT - 2

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of the supervisor, Configuring and installing of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

UNIT - 3

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris.

UNIT - 4

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

UNIT - 5

VIRTUAL MEMORY: Virtual memory basics, Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing, UNIX virtual memory.

UNIT - 6

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system.

UNIT - 7

SCHEDULING: Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling, Process scheduling in UNIX.

UNIT - 8

MESSAGE PASSING: Implementing message passing, Mailboxes, Inter process communication in UNIX.

TEXT BOOK:

1. **“Operating Systems - A Concept based Approach”**, D. M. Dhamdhare, TMH, 3rd Ed, 2010.

REFERENCE BOOK:

1. **Operating Systems Concepts**, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th Edition, 2001.
2. **Operating System – Internals and Design Systems**, Willaim Stalling, Pearson Education, 4th Ed, 2006.
3. **Design of Operating Systems**, Tennambhaum, TMH, 2001.

ADVANCED COMMUNICATION LAB

Subject Code	: 10ECL67	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

LIST OF EXPERIMENTS USING DESCERTE COMPONENTS and LABVIEW – 2009 can be used for verification and testing.

1. TDM of two band limited signals.
2. ASK and FSK generation and detection
3. PSK generation and detection
4. DPSK generation and detection
5. QPSK generation and detection
6. PCM generation and detection using a CODEC Chip
7. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture
8. Analog and Digital (with TDM) communication link using optical fiber.
9. Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench
10. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).
11. Determination of coupling and isolation characteristics of a stripline (or microstrip) directional coupler
12. (a) Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate.

(b) Measurement of power division and isolation characteristics of a microstrip 3 dB power divider.

MICROPROCESSOR LAB

Subject Code	: 10ECL68	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

I) Programs involving

- 1) Data transfer instructions like:
 - i] Byte and word data transfer in different addressing modes.
 - ii] Block move (with and without overlap)
 - iii] Block interchange

- 2) Arithmetic & logical operations like:
 - i] Addition and Subtraction of multi precision nos.
 - ii] Multiplication and Division of signed and unsigned Hexadecimal nos.
 - iii] ASCII adjustment instructions
 - iv] Code conversions
 - v] Arithmetic programs to find square cube, LCM, GCD, factorial

- 3) Bit manipulation instructions like checking:
 - i] Whether given data is positive or negative
 - ii] Whether given data is odd or even
 - iii] Logical 1's and 0's in a given data
 - iv] 2 out 5 code
 - v] Bit wise and nibble wise palindrome

- 4) Branch/Loop instructions like:
 - i] Arrays: addition/subtraction of N nos.
Finding largest and smallest nos.
Ascending and descending order
 - ii] Near and Far Conditional and Unconditional jumps, Calls and Returns

- 5) Programs on String manipulation like string transfer, string reversing, searching for a string, etc.

- 6) Programs involving Software interrupts
Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console
- II) Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output-PCI bus compatible) card
 - a) Matrix keyboard interfacing
 - b) Seven segment display interface
 - c) Logical controller interface
 - d) Stepper motor interface
- III) Other Interfacing Programs
 - a) Interfacing a printer to an X86 microcomputer
 - b) PC to PC Communication

ELECTIVE – GROUP A

ANALOG AND MIXED MODE VLSI DESIGN

Subject Code	: 10EC661	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

(Text Book 1)

UNIT 1

Data converter fundamentals: Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.

UNIT 2

Data Converters Architectures: DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC, ADC Architectures, Flash, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

UNIT 3

Non-Linear Analog Circuits: Basic CMOS Comparator Design (Excluding Characterization), Analog Multipliers, Multiplying Quad (Excluding Stimulation), Level Shifting (Excluding Input Level Shifting For Multiplier).

(Text Book 2)

UNIT 4:

Data Converter SNR: Improving SNR Using Averaging (Excluding Jitter & Averaging onwards), Decimating Filters for ADCs (Excluding Decimating

UNIT - 2

Power dissipation in CMOS – Short circuit dissipation, dynamic dissipation, Load capacitance. Low power design limits - Principles of low power design, Hierarchy of limits, fundamental limits, Material, device, circuit and system limits.

UNIT – 3&4

SYNTHESIS FOR LOW POWER: Behavioral, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, voltage scaling, operation reduction and substitution, pre- computation, FSM and Combinational logic, Transistor sizing.

UNIT – 5&6

DESIGN AND TEST OF LOW-VOLTAGE CMOS CIRCUITS: Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V_{gs} , steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages.

UNIT - 7

LOW ENERGY COMPUTING: Energy dissipation in transistor channel, Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic and SRAM core, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation.

UNIT - 8

SOFTWARE DESIGN FOR LOW POWER: Introduction, sources of power dissipation, power estimation and optimization.

TEXT BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy and Sharat C Prasad, John Wiley Pvt. Ltd, 2008.

DATA STRUCTURE USING C++

Subject Code : **10EC665**

IA Marks : 25

No. of Lecture Hrs/Week : 04

Exam Hours : 03

UNIT - 1

INTRODUCTION: Functions and parameters, Dynamic memory allocation classis, Testing and debugging. Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing simulating pointers.

UNIT - 2

ARRAYS AND MATRICES: Arrays, Matrices, Special matrices spare matrices.

UNIT - 3

STACKS: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications.

UNIT - 4

Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked Linked representation, Applications.

UNIT - 5

SKIP LISTS AND HASHING: Dictionaries, Linear representation, Skip list presentation, Hash table representation.

UNIT - 6

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.

UNIT - 7

PRIORITY QUEUES: Linear lists, Heaps, Leftist trees.

UNIT-8

Search Trees: Binary search trees, B-trees, Applications.

TEXT BOOK:

1. **Data structures, Algorithms, and applications in C++** - Sartaj Sahni, McGraw Hill.2000.

REFERENCE BOOKS:

1. **Object Oriented Programming in C++** - Balaguruswamy. TMH, 1995.
2. **Programming in C++** - Balaguruswamy. TMH, 4th, 2010 .

DIGITAL SYSTEMS DESIGN USING VHDL

Subject Code	: 10EC666	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter.

UNIT - 2

DESIGNING WITH PROGRAMMABLE LOGIC DEVICES: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner.

UNIT - 3

DESIGN OF NETWORKS FOR ARITHMETIC OPERATIONS: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider.

UNIT - 4

DIGITAL DESIGN WITH SM CHARTS: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

UNIT - 5

DESIGNING WITH PROGRAMMABLE GATE ARRAYS AND COMPLEX PROGRAMMABLE LOGIC DEVICES: Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.

Resolution and sampling frequency – Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi channel analog inputs. Concept of universal DAQ card – Use of timer-counter and analog outputs on the universal DAQ card.

UNIT 3

Cluster of Instruments in System: Interfacing of external instruments to a PC – RS 232C, RS – 422, RS 485 and USB standards – IEEE 488 standard – ISO –OSI model for series bus – introduction to bus protocols of MOD bus and CAN bus.

UNIT 4

Graphical Programming Environment in VI: Concepts of graphical programming – Lab-view software – Concept of VIs and sub VIs – Display types – Digital – Analog – Chart – Oscilloscope types – Loops – Case and sequence structures – Types of data – Arrays – Formulate nodes – Local and Global variables – String and file I/O.

UNIT 5

Analysis Tools and Simple Application in VI: Fourier transform – Power spectrum – Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – PID controller – CRO emulation – Simulation of a simple second order system – Generation of HTML page.

Reference Books:

1. S. Gupta and J P Gupta, "PC Interfacing for Data Acquisition and Process Control", Instrument Society of America, 1994
2. Peter W Gofton , "Understanding Serial Communication", Sybes International, 2000
3. Robert H. Bishop, "Learning with Lab-View" Prentice Hall, 2009
4. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
5. Ernest O. Doebelin and Dhanesh N Manik, " Measurement Systems – Application and Design", 5th Edn, TMH, 2007.

VII SEMESTER

COMPUTER COMMUNICATION NETWORKS

Subject Code	: 10EC71	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC.

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation.

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Backbone Networks, Virtual LANs

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6.

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

1. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: 10EC72	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors.

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Digital links – Introduction, point-to-point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

TEXT BOOKS:

1. "**Optical Fiber Communication**", Gerd Keiser, 4th Ed., MGH, 2008.
2. "**Optical Fiber Communications**", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: 10EC73	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base drive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1ϕ fully controlled converters, Dual converters, 1ϕ semi converters (all converters with R & RL load).

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with resistive loads and Inductive loads, numerical problems.

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification, Switch mode regulators – buck, boost and buck – boost regulators.

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1ϕ bridge inverter, voltage control of 1ϕ invertors, current source invertors, Variable DC link inverter.

TEXT BOOKS:

1. **“Power Electronics”** - M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
2. **“Power Electronics”** - M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

1. **“Power Electronics, Essentials and Applications”, L Umanand,** John Wiley India Pvt. Ltd, 2009.
2. **“Power Electronics”** , Daniel W. Hart, McGraw Hill, 2010.
3. **“Power Electronics”**, V Nattarasu and R.S. Anandamurthy, Pearson/Sanguine Pub. 2006.

EMBEDDED SYSTEM DESIGN

Subject Code	: 10EC74	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process.

UNIT 2:

The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor
 The Hardware Side: Storage Elements and Finite-State Machines (2 hour)
 The concepts of State and Time, The State Diagram, Finite State Machines-A Theoretical Model.

UNIT 3:

Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation.

UNIT 4:

Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The

Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project.

UNIT 5 & 6:

Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited

UNIT 7 & 8:

Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance

Text Book:

1. **Embedded Systems – A contemporary Design**
Tool, James K. Peckol, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. **Embedded Systems: Architecture and Programming**, Raj Kamal, TMH. 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Programming for Embedded Systems**, Dreamtech Software Team, John Wiley India Pvt. Ltd, 2008

VLSI LAB

Subject Code : **10ECL77**
No. of Practical Hrs/Week : 03
Total no. of Practical Hrs. : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

(Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used)

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesize** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

- i. An inverter
- ii. A Buffer
- iii. Transmission Gate
- iv. Basic/universal gates
- v. Flip flop -RS, D, JK, MS, T
- vi. Serial & Parallel adder
- vii. 4-bit counter [Synchronous and Asynchronous counter]
- viii. Successive approximation register [SAR]

** An appropriate constraint should be given*

PART - B

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:

- a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis

b. **Draw the Layout** and verify the DRC, ERC

c. Check for LVS

d. Extract RC and back annotate the same and verify the Design

e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:

- a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis

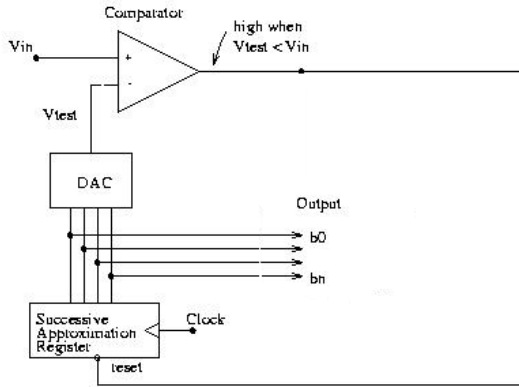
- iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier
 - ii) Common source and Common Drain amplifier

- 3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

- 5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



- * Appropriate specification should be given.
- ** Applicable Library should be added & information should be given to the Designer.
- *** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: 10ECL78	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

Any five converter circuits experiment from the below list **must be** simulated using the **spice-simulator**.

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT.
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using i) LC circuit ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of a separately excited DC motor.
11. Speed control of universal motor.

12. Speed control of stepper motor.

13. Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: 10EC751	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control.

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

TEXT BOOK:

1. **“Digital Signal Processing”**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Iffachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **“Digital Signal Processors”**, B Venkataramani and M Bhaskar TMH, 2nd, 2010
3. **“Architectures for Digital Signal Processing”**, Peter Pirsch John Wiley, 2008

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	: 10MS752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 10
			0

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

a) What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.

Multiple Inheritances, public, private & protected inheritance, Class scope under Inheritance.

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

REAL-TIME SYSTEMS

Subject Code	: 10EC762	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface.

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages.

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples.

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors.

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hatley and Pirbhai Method.

TEXT BOOKS:

1. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: 10EC81	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware.

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2nd, 2009.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, “**Wireles and Mobile Network concepts and protocols**”, John Wiley India Pvt. Ltd, 1st edition, 2010.
5. “**Wireless Communication – Principles & Practice**”, T.S. Rappaport, PHI 2001.

DIGITAL SWITCHING SYSTEMS

Subject Code	: 10EC82	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis.

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis.

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood: Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India India Pvt. Ltd, 3rd Ed, 2008.

ELECTIVE –4 (GROUP D)

DISTRIBUTED SYSTEM

Subject Code	: 10EC831	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Client-server communication, Group communication.

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

UNIT - 2

SYMMETRIC CIPHERS: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

UNIT - 3

Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions.

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard.

UNIT - 5

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.

UNIT - 6

Intruders, Intrusion Detection, Password Management.

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures.

UNIT - 8

Firewalls Design Principles, Trusted Systems.

TEXT BOOK:

1. **Cryptography and Network Security**, William Stalling, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

OPTICAL NETWORKS

Subject Code

: **10EC833**

IA Marks

: 25

No. of Lecture Hrs/Week : 04
Total no. of Lecture Hrs. : 52

Exam Hours : 03
Exam Marks : 100

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons.

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers.

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters.

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration.

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks.

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations.

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment

considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

TEXT BOOK:

1. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

1. **Optical Communication Networks:** Biswajit Mukherjee: TMG 1998.
2. **Optical Networks,** Ulysees Black: Pearson education 2007.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: 10EC834	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE:

Applications, Traffic characterization and quality of services, Network services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks.

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks.

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV.

UNIT - 5

GSM

Subject Code	: 10EC843	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers.

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna.

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification.

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. **MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services.

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

TEXT BOOK:

1. **“Principles of Applications of GSM”**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication**, [Friedhelm Hillebrand](#), John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: 10EC844	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols.

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT - 6

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a transport layer protocol

for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning.

UNIT - 8

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

TEXT BOOK:

1. “Ad hoc wireless Networks”, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. “Ad hoc wireless Networks”, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. “Ad hoc wireless Networking”, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: 10EC845	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens , sampling and quantization, image enhancement, image restoration.

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring.

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations.

SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics -III*	04		03	80	20	100	4
2	15EC32	Analog Electronics	04		03	80	20	100	4
3	15EC33	Digital Electronics	04		03	80	20	100	4
4	15EC34	Network Analysis	04		03	80	20	100	4
5	15EC35	Electronic Instrumentation	04		03	80	20	100	4
6	15EC36	Engineering Electromagnetics	04		03	80	20	100	4
7	15ECL37	Analog Electronics Lab		1I+2P	03	80	20	100	2
8	15ECL38	Digital Electronics Lab		1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP31	Additional Mathematics - I	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical / Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT41	Engineering Mathematics -IV*	04		03	80	20	100	4
2	15EC42	Microprocessor	04		03	80	20	100	4
3	15EC43	Control Systems	04		03	80	20	100	4
4	15EC44	Signals and Systems	04		03	80	20	100	4
5	15EC45	Principles of Communication Systems	04		03	80	20	100	4
6	15EC46	Linear Integrated Circuits	04		03	80	20	100	4
7	15ECL47	Microprocessor Lab		11+2P	03	80	20	100	2
8	15ECL48	Linear ICs and Communication Lab		11+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP41	Additional Mathematics - II	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical /Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15ES51	Management and Entrepreneurship Development	04		03	80	20	100	4
2	15EC52	Digital Signal Processing	04		03	80	20	100	4
3	15EC53	Verilog HDL	04		03	80	20	100	4
4	15EC54	Information Theory & Coding	04		03	80	20	100	4
5	15EC55X	Professional Elective-1	03		03	80	20	100	3
6	15EC56X	Open Elective-1	03		03	80	20	100	3
7	15ECL57	DSP Lab		11+2P	03	80	20	100	2
8	15ECL58	HDL Lab		11+2P	03	80	20	100	2
TOTAL			22	06	24	640	160	800	26

Professional Elective-1		Open Elective-1	
15EC553	Operating System	15EC562	Object Oriented Programming in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15EC61	Digital Communication	04		03	80	20	100	4
2	15EC62	ARM Microcontroller & Embedded Systems	04		03	80	20	100	4
3	15EC63	VLSI Design	04		03	80	20	100	4
4	15EC64	Computer Communication Networks	04		03	80	20	100	4
5	15EC65X	Professional Elective-2	03		03	80	20	100	3
6	15EC66X	Open Elective-2	03		03	80	20	100	3
7	15ECL67	Embedded Controller Lab		1I+2P	03	80	20	100	2
8	15ECL68	Computer Networks Lab		1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective-2		Open Elective-2	
15EC653	Artificial Neural Network	15EC661	Data Structures in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			15EC	
			Theory	Practical/Drawing	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	15EC71	Microwave and Antennas	04		03	20	80	100	4
2	15EC72	Digital Image Processing	04		03	20	80	100	4
3	15EC73	Power Electronics	04		03	20	80	100	4
4	15XX74X	Professional Elective-3	03		03	20	80	100	3
5	15EC75X	Professional Elective-4	03		03	20	80	100	3
6	15ECL76	Advanced Communication Lab		1I+2P	03	20	80	100	2
7	15ECL77	VLSI Lab		1I+2P	03	20	80	100	2
8	15ECP78	Project Work Phase-I + Project work Seminar		03		100	-	100	2
TOTAL			18	09	21	240	560	800	24

Professional Elective-3		Professional Elective-4	
15EC743	Real Time System	15EC751	DSP algorithms & Architecture

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EC81	Wireless Cellular and LTE 4G Broadband	4	-	3	20	80	100	4
2	15EC82	Fiber Optics & Networks	4	-	3	20	80	100	4
3	15EC83X	Professional Elective-5	3	-	3	20	80	100	3
4	15EC84	Internship/Professional Practice	Industry Oriented		3	50	50	100	2
5	15ECP85	Project Work	-	6	3	100	100	200	6
6	15ECS86	Seminar	-	4	-	100	-	100	1
TOTAL			11	10	15	310	390	700	20

Professional Elective-5	
15EC833	RADAR Engg.

**B.E., III Semester, Electronics & Communication Engineering
/Telecommunication Engineering**

ENGINEERING MATHEMATICS-III B.E., III Semester, Common to all Branches [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Introduce most commonly used analytical and numerical methods in the different engineering fields. • Learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods. • Solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Modules			RBT Level
Module-1			
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			L1, L2, L4
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			L2, L3, L4
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) -Problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.			L3
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof)-Problems.			L3

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems.</p>	<p>L3, L4</p> <p>L2, L4</p>
<p>Course outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functionals and solve the simple problems of the calculus of variations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i> 2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
<p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - I
B.E., III Semester, Common to all Branches
(A Bridge course for Lateral Entry students of III Sem. B. E.)
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15MATDIP31	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation. • Solve first order differential equations. 			
Modules			RBT Level
Module-1			
<p>Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).</p> <p>Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems.</p>			L1
Module-2			
<p>Differential Calculus: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem (without proof). Polar curves-angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application to Jacobians.</p>			L1, L2
Module-3			
<p>Integral Calculus: Statement of reduction formulae for $\sin^n x$, $\cos^n x$, and $\sin^m x \cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.</p>			L1, L2
Module-4			
<p>Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.</p>			L1, L2
Module-5			
<p>Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types.</p>			L1, L2

<p>Course outcomes: On completion of the course, students are able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in related area. • Use derivatives and partial derivatives to calculate rates of change of multivariate functions. • Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region. • Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions. • Recognize and solve first-order ordinary differential equations occurring in different branches of engineering. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.</i> 	

ANALOG ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain various BJT parameters, connections and configurations. • Explain BJT Amplifier, Hybrid Equivalent and Hybrid Models. • Explain construction and characteristics of JFETs and MOSFETs. • Explain various types of FET biasing, and demonstrate the use of FET amplifiers. • Construct frequency response of BJT and FET amplifiers at various frequencies. • Analyze Power amplifier circuits in different modes of operation. • Construct Feedback and Oscillator circuits using FET. 			
Modules			RBT Level
Module -1			
<p>BJT AC Analysis: BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid Model.</p>			L1, L2,L3
Module -2			
<p>Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.</p> <p>FET Amplifiers: JFET small signal model, Fixed bias configuration, Self bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.</p>			L1, L2, L3
Module -3			
<p>BJT and JFET Frequency Response: Logarithms, Decibels, Low frequency response - BJT Amplifier with RL, Low frequency response-FET Amplifier, Miller effect capacitance, High frequency response - BJT Amplifier, High frequency response-FET Amplifier, Multistage Frequency Effects.</p>			L1, L2, L3
Module -4			

<p>Feedback and Oscillator Circuits: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wien bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Power Amplifiers: Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers. Voltage Regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers. • Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT. • Calculate the AC gain and impedance for BJT using re and h parameters models for CE and CC configuration. • Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model. • Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics. • Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Robert L. Boylestad and Louis Nashelsky, “Electronics devices and Circuit theory”, Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Adel S. Sedra and Kenneth C. Smith, “Micro Electronic Circuits Theory and Application”, 5th Edition ISBN:0198062257 2. Fundamentals of Microelectronics, Behzad Razavi, John Wiley ISBN 2013 978-81-265-2307-8 3. J.Millman & C.C.Halkias Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424. 	

DIGITAL ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques. • Design combinational logic circuits. • Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators. • Describe Latches and Flip-flops, Registers and Counters. • Analyze Mealy and Moore Models. • Develop state diagrams Synchronous Sequential Circuits. 			
Modules			RBT Level
Module - 1			
<p>Principles of combination logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables.(Text 1, Chapter 3)</p>			L1, L2, L3
Module -2			
<p>Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.(Text 1, Chapter 4)</p>			L1, L2, L3
Module -3			
<p>Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops,JK flip-flops, Edge triggered flip-flops, Characteristic equations. (Text 2, Chapter 6)</p>			L1,L2
Module -4			
<p>Simple Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counters, Design of a synchronous mod-n counter using clocked T , JK , D and SR flip-flops. (Text 2, Chapter 6)</p>			L1,L2, L3

Module -5	
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. (Text 1, Chapter 6)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques. • Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators. • Explain the working of Latches and Flip Flops (SR,D,T and JK). • Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops. • Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. • Apply the knowledge gained in the design of Counters and Registers. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1. 2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002. ISBN 978-0-07-052906-9. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. D. P. Kothari and J. S Dhillon, “Digital Circuits and Design”, Pearson, 2016, ISBN:9789332543539. 2. Morris Mano, “Digital Design”, Prentice Hall of India, Third Edition. 3. Charles H Roth, Jr., “Fundamentals of logic design”, Cengage Learning. 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424. 	

NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC34	IA Marks	20
Number	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course enables students to:			
<ul style="list-style-type: none"> • Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power. • Explain network Thevenin's, Millman's, Superposition, Reciprocity, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits. • Explain the behavior of networks subjected to transient conditions. • Use applications of Laplace transforms to network problems. • Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response. • Study two port network parameters like Z, Y, T and h and their inter-relationships and applications. 			
Modules			RBT Level
Module -1			
Basic Concepts: Practical sources, Source transformations, Network reduction using Star - Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.			L1, L2,L3,L4
Module -2			
Network Theorems: Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem.			L1, L2, L3,L4
Module -3			
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.			L1, L2, L3,L4
Module -4			
Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q-Factor, Bandwidth.			L1, L2, L3,L4
Module -5			

<p>Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets.</p>	<p>L1, L2, L3,L4</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting. • Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions. • Calculate current and voltages for the given circuit under transient conditions. • Apply Laplace transform to solve the given network. • Evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits • Solve the given network using specified two port network parameter like Z or Y or T or h. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958. 2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010. 2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8thed, 2006. 3. Charles K Alexander and Mathew N O Sadiku, " Fundamentals of Electric Circuits", Tata McGraw-Hill, 3rd Ed, 2009. 	

ELECTRONIC INSTRUMENTATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define and describe accuracy and precision, types of errors, statistical and probability analysis. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of various Analog and Digital measuring instruments. • Describe basic concepts and operation of Digital Voltmeters and Microprocessor based instruments. • Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges. • Recognize and describe significance and working of different types of transducers. 			
Modules			RBT Level
<p>Module -1 Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations, Basics of Statistical Analysis. (Text 2)</p> <p>Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)</p> <p>Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. Transistor Voltmeter, Differential Voltmeter, True RMS Voltmeter, Considerations in Choosing an Analog Voltmeter, Multimeter. (Text 1)</p>			L1, L2, L3
Module -2			

<p>Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Continuous Balance DVM, $3\frac{1}{2}$-Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, Microprocessor based Ramp type DVM. (Text 1)</p> <p>Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, Microprocessor based Instruments. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -3</p>	
<p>Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Storage Oscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)</p> <p>Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, Square and Pulse Generator, Sweep Generator. (Text 1)</p>	<p>L1, L2</p>
<p>Module -4</p>	
<p>Measuring Instruments: Output Power Meters, Field Strength Meter, Stroboscope, Phase Meter, Vector Impedance Meter, Q Meter, Megger, Analog pH Meter. (Text 1)</p> <p>Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -5</p>	
<p>Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers, LVDT, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo diode and transistor, Temperature transducers-RTD. (Text 1)</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe instrument measurement errors and calculate them. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions. • Describe functional concepts and operation of various Analog measuring instruments to measure output power, field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance and pH. • Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers. • Utilize AC and DC bridges for passive component and frequency measurements. 	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.

Reference Books:

1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN:9789332556065.
2. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai & Sons. ISBN -81-7700-016-0

ENGINEERING ELECTROMAGNETICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient. • Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions. • Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions. • Infer the effects of magnetic forces, materials and inductance. • Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behaviour in different media • Acquire knowledge of Poynting theorem and its application of power flow. 			
Modules		RBT Level	
Module - 1			
Coulomb's Law, Electric Field Intensity and Flux density Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density.		L1, L2, L3	
Module -2			
Gauss's law and Divergence Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem. Energy, Potential and Conductors Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current.		L1, L2, L3	
Module -3			
Poisson's and Laplace's Equations Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation. Steady Magnetic Field Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials.		L1, L2, L3	
Module -4			

<p>Magnetic Forces Force on a moving charge, differential current elements, Force between differential current elements.</p> <p>Magnetic Materials Magnetisation and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials.</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Time-varying fields and Maxwell's equations Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.</p> <p>Uniform Plane Wave Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. • Determine potential and energy with respect to point charge and capacitance using Laplace equation. • Calculate magnetic field, force, and potential energy with respect to magnetic materials. • Apply Maxwell's equation for time varying fields, EM waves in free space and conductors. • Evaluate power associated with EM waves using Poynting theorem. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2009, ISBN-978-0-07-061223-5.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John Krauss and Daniel A Fleisch, " Electromagnetics with applications", McGraw-Hill. 2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson. 	

ANALOG ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL37	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:</p> <ul style="list-style-type: none"> • Rectifiers and Voltage Regulators. • BJT characteristics and Amplifiers. • JFET Characteristics and Amplifiers. • MOSFET Characteristics and Amplifiers • Power Amplifiers. • RC-Phase shift, Hartley, Colpitts and Crystal Oscillators. 			
NOTE: The experiments are to be carried using discrete components only.			
Laboratory Experiments:			
1. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency: (a) Full Wave Rectifier (b) Bridge Rectifier			
2. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).			
3. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.			
4. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.			
5. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.			
6. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.			
7. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.			

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
10. Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
11. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
12. Design and set-up the crystal oscillator and determine the frequency of oscillation.
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators. • Determine the characteristics of BJT and FET amplifiers and plot its frequency response. • Compute the performance parameters of amplifiers and voltage regulators • Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

DIGITAL ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL38	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Mark	80
RBT Level	L1, L2, L3	Exam Hour	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, realisation and verification of</p> <ul style="list-style-type: none"> • Demorgan's Theorem, SOP, POS forms • Full/Parallel Adders, Subtractors and Magnitude Comparator • Multiplexer using logic gates • Demultiplexers and Decoders • Flip-Flops, Shift registers and Counters 			
<p>NOTE:</p> <ol style="list-style-type: none"> 1. Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used. 2. For experiment No. 11 and 12 any open source or licensed simulation tool may be used. 			
Laboratory Experiments:			
1. Verify			
(a) Demorgan's Theorem for 2 variables.			
(b) The sum-of product and product-of-sum expressions using universal gates.			
2. Design and implement			
(a) Full Adder using basic logic gates.			
(b) Full subtractor using basic logic gates.			
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.			
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.			
5. Realize			
(a) 4:1 Multiplexer using gates.			
(b) 3-variable function using IC 74151(8:1MUX).			
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.			
7. Realize the following flip-flops using NAND Gates.			
(a) Clocked SR Flip-Flop (b) JK Flip-Flop.			
8. Realize the following shift registers using IC7474			
(a) SISO (b) SIPO (c) PISO (d) PIPO.			
9. Realize the Ring Counter and Johnson Counter using IC7476.			
10. Realize the Mod-N Counter using IC7490.			

11. Simulate Full- Adder using simulation tool.

12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
- Construct and test flips-flops, counters and shift registers.
- Simulate full adder and up/down counters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B.E E&C FOURTH SEMESTER SYLLABUS

ENGINEERING MATHEMATICS-IV			
B.E., IV Semester, Common to all Branches			
[As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits - 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. 			
Modules			RBT Level
Module-1			
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).			L1, L3
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method.			
Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$ -Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue's formula, problems.			L3
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems.			L1, L3,
Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z+(1/z)(z \neq 0)$ and bilinear transformations-problems.			L3
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.			L3

<p>Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.</p>	
<p>Module-5</p>	
<p>Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.</p>	<p>L3</p>
<p>Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.</p>	<p>L1</p>
<p>Course Outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods. • Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory. • Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing. • Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems. • Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering. • Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis. • Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events. • Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books: <i>1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	

2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i>	
Reference Books:	
<ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
Web Link and Video Lectures:	
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - II
B.E., IV Semester, Common to all Branches
(A Bridge course for Lateral Entry students of IV Sem. B. E.)
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15MATDIP41	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
Course Objectives: This course will enable students to: <ul style="list-style-type: none"> • Understand essential concepts of linear algebra. • Solve second and higher order differential equations. • Understand Laplace and inverse Laplace transforms and elementary probability theory. 			
Modules			RBT Level
Module-1			
Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.			L1,L3
Module-2			
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of undetermined coefficients and variation of parameters.			L1,L3
Module-3			
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only.			L1,L2
Module-4			
Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Application to solutions of Linear differential equations and simultaneous differential equations.			L1,L2
Module-5			
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples.			L1,L2
Course Outcomes: On completion of this course, students are able to: <ul style="list-style-type: none"> • Solve systems of linear equations in the different areas of linear algebra. • Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations. 			

<ul style="list-style-type: none"> • Describe Laplace transforms of standard and periodic functions. • Determine the general/complete solutions to linear ODE using inverse Laplace transforms. • Recall basic concepts of elementary probability theory and, solve problems related to the decision theory, synthesis and optimization of digital circuits. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10^h Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7^h Ed., 2007.</i> 	

MICROPROCESSORS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Familiarize basic architecture of 8086 microprocessor • Program 8086 Microprocessor using Assembly Level Language • Use Macros and Procedures in 8086 Programs • Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design • Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures 			
Modules			RBT Level
Module -1			
<p>8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text).</p> <p>Addressing modes, Machine language instruction formats, Machine coding the program (2.2, 2.1, 3.2 of Text).</p> <p>INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text).</p>			L1, L2, L3
Module -2			
<p>Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text).</p>			L1, L2, L3
Module -3			
<p>Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Passing parameters to procedures, Macros, Timing and Delays. (Chap. 4 of Text).</p>			L1, L2, L3
Module -4			

<p>8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).</p> <p>Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255 (Refer 5.3, 5.4, 5.5 of Text).</p>	<p>L1, L2, L3</p>
<p>Module 5</p>	
<p>Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes (refer 6.1 of Text).</p> <p>INT 21H DOS Function calls - for handling Keyboard and Display (refer Appendix-B of Text).</p> <p>Other Architectures: Architecture of 8088 (refer 1.10 upto 1.10.1 of Text) and Architecture of NDP 8087 (refer 8.3.1, 8.3.5 of Text).</p> <p>Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students will be able to:</p> <ul style="list-style-type: none"> • Explain the History of evaluation of Microprocessors, Architecture and instruction set of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086. • Write 8086 Assembly level programs using the 8086 instruction set • Write modular programs using procedures and macros. • Write 8086 Stack and Interrupts programming • Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors. • Use INT 21 DOS interrupt function calls to handle Keyboard and Display. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Book:

Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. **Microcomputer systems-The 8086 / 8088 Family** - Y.C. Liu and A. Gibson, 2nd edition, PHI -2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** - Kenneth J Ayala, CENGAGE Learning, 2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

CONTROL SYSTEMS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - IV (EC/TC)			
Subject Code	15EC43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the basic features, configurations and application of control systems. • Understand various terminologies and definitions for the control systems. • Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems. • Know how to find time response from the transfer function. • Find the transfer function via Masons' rule. • Analyze the stability of a system from the transfer function. 			
Modules			RBT Level
Module -1			
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems - Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.			L1, L2, L3
Module -2			
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).			L1, L2, L3
Module -3			
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.			L1, L2, L3
Module -4			

<p>Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalisation.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, the students will be able to</p> <ul style="list-style-type: none"> • Develop the mathematical model of mechanical and electrical systems • Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method • Determine the time domain specifications for first and second order systems • Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. • Determine the stability of a system in the frequency domain using Nyquist and bode plots • Develop a control system model in continuous and discrete time using state variable techniques 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: J.Nagarath and M.Gopal, “ Control Systems Engineering”, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Modern Control Engineering,” K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7. 2. “Automatic Control Systems”, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 3. “Feedback and Control System,” Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007. 	

SIGNALS AND SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the mathematical description of continuous and discrete time signals and systems. • Analyze the signals in time domain using convolution difference/differential equations • Classify signals into different categories based on their properties. • Analyze Linear Time Invariant (LTI) systems in time and transform domains. • Build basics for understanding of courses such as signal processing, control system and communication. 			
Modules			RBT Level
Module -1			
<p>Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.</p> <p>Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.</p> <p>Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.</p> <p>Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.</p>			L1, L2, L3
Module -2			
<p>Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.</p>			L1, L2, L3
Module -3			

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours). Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours).	L1, L2, L3
Module -4	
Fourier Representation of aperiodic Signals: FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours). FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours). Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours).	L1, L2, L3
Module -5	
Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems.	L1, L2, L3
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals. • Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems. • Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. • Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis. • Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems. 	
Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book:	
Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.	

Reference Books:

1. **Michael Roberts**, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan**, "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.

PRINCIPLES OF COMMUNICATION SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals. • Understand the concepts in Angle modulation for the design of communication systems. • Design simple systems for generating and demodulating frequency modulated signals. • Learn the concepts of random process and various types of noise. • Evaluate the performance of the communication system in presence of noise. • Analyze pulse modulation and sampling techniques. 			
Modules			RBT Level
Module - 1			
<p>AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency - Domain description, Switching modulator, Envelop detector.</p> <p>DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency - Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.</p> <p>SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text).</p>			L1, L2, L3
Module - 2			
<p>ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text).</p>			L1, L2, L3
Module - 3			

<p>RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions (refer Chapter 5 of Text).</p> <p>NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 4</p>	
<p>NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 5</p>	
<p>DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Determine the performance of analog modulation schemes in time and frequency domains. • Determine the performance of systems for generation and detection of modulated analog signals. • Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms. • Characterize the influence of channel on analog modulated signals • Determine the performance of analog communication systems. • Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Communication Systems, Simon Haykins & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 - 81 - 265 - 2151 - 7.</p>	
<p>Reference Books:</p>	

1. **Modern Digital and Analog Communication Systems**, B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems: Analog and Digital**, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

LINEAR INTEGRATED CIRCUITS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define and describe various parameters of Op-Amp, its characteristics and specifications. • Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits. • Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters. • Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate. • Describe and Sketch the various switching circuits of Op-Amps and analyze its operations. • Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs. 			
Modules			RBT Level
Module -1			
<p>Operational Amplifier Fundamentals: Basic Op-amp circuit, Op-Amp parameters - Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. OP-Amps as DC Amplifiers - Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet.(Text1)</p>			L1, L2,L3
Module -2			
<p>Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance - Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance - Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.(Text1)</p>			L1, L2,L3
Module-3			
<p>More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider. (Text2)</p>			L1, L2,L3

Module -4	
<p>Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. (Text 1)</p> <p>Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. (Text 2)</p>	L1, L2,L3
Module -5	
<p>Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. (Text 2)</p>	L1, L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. • Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. • Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. • Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. • Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. • Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9. 2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4thedition, Reprint 2006, New Age International ISBN 978-81-224-3098-1. 	

Reference Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, "Linear Integrated Circuits: Analysis, Design & Applications," Wiley India, 1st Edition, 2015.
3. James Cox, "Linear Electronics Circuits and Devices", Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.

MICROPROCESSOR LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL47	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:

- i) Byte and word data transfer in different addressing Modes
- ii) Block move (with and without overlap)
- iii) Block interchange

2. Programs involving:

Arithmetic & logical operations like:

- i) Addition and Subtraction of multi precision nos.
- ii) Multiplication and Division of signed and unsigned Hexadecimal nos.
- iii) ASCII adjustment instructions.
- iv) Code conversions.

3. Programs involving:

Bit manipulation instructions like checking:

- i) Whether given data is positive or negative
- ii) Whether given data is odd or even
- iii) Logical 1's and 0's in a given data
- iv) 2 out 5 code
- v) Bit wise and nibble wise palindrome

4. Programs involving:

Branch/ Loop instructions like

- i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
- ii) Two application programs using Procedures and Macros (Subroutines).

<p>5. Programs involving</p> <p>String manipulation like string transfer, string reversing, searching for a string.</p>
<p>6. Programs involving</p> <p>Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.</p>
<p>7. Interfacing Experiments:</p> <p>Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)</p> <ol style="list-style-type: none"> 1. Matrix keyboard interfacing 2. Seven segment display interface 3. Logical controller interface 4. Stepper motor interface 5. ADC and DAC Interface (8 bit) 6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. • Understand assembler directives, branch, loop operations and DOS 21H Interrupts. • Write and execute 8086 assembly level programs to sort and search elements in a given array. • Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. • Utilize procedures and macros in programming 8086. • Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one question from software and one question from hardware interfacing to be set. • Students are allowed to pick one experiment from the lot. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

LINEAR ICS AND COMMUNICATION LAB

As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL48	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This laboratory course enables students to:

- Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp
- Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations.
- Design, Demonstrate and Analyze balance modulation and frequency synthesis.
- Demonstrate and Analyze pulse sampling and flat top sampling.

Laboratory Experiments:

1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.
3. Design active second order Butterworth low pass and high pass filters.
4. Design 4 bit R - 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
5. Design Adder, Integrator and Differentiator using Op-Amp.
6. Design of Monostable and Astable Multivibrator using 555 Timer.
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.
8. Amplitude modulation using transistor/FET (Generation and detection).
9. Frequency modulation using IC 8038/2206 and demodulation.
10. Design BJT/FET Mixer.
11. DSBSC generation using Balance Modulator IC 1496/1596.
12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C FIFTH SEMESTER SYLLABUS

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

B.E., V Semester, EC/TC/EI/BM/ML

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ES51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: This course will enable students to:

- Understand basic skills of Management
- Understand the need for Entrepreneurs and their skills
- Understand Project identification and Selection
- Identify the Management functions and Social responsibilities
- Distinguish between management and administration

Module-1	RBT Level
<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).</p> <p>Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making(Selected topics from Chapters 4 & 5, Text 1).</p>	L1, L2
Module-2	
<p>Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees-Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11,Text 1).</p> <p>Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow’s Need-Hierarchy Theory and Herzberg’s Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process (Selected topics from Chapters 15 to 18 and 9, Text 1).</p>	L1, L2
Module-3	
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).</p>	L1, L2

<p>Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship (Selected topics from Chapter 2, Text 2).</p>	
Module-4	
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only)(Selected topics from Chapter1, Text 2).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics from Chapter 4, Text 2).</p>	L1, L2
Module-5	
<p>Projects Management: AProject. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.</p> <p>Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.</p> <p>(Selected topics from Chapters 16 to 20 of Unit 3, Text 3).</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of Management and Entrepreneurship • Select a best Entrepreneurship model for the required domain of establishment • Describe the functions of Managers, Entrepreneurs and their social responsibilities • Compare various types of Entrepreneurs • Analyze the Institutional support by various state and central government agencies 	
<p>Question paper pattern</p> <ul style="list-style-type: none"> • The question paper will have TEN questions. • Each full question carries 16 marks. • There will be two full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

Reference Book:

Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

DIGITAL SIGNAL PROCESSING
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

- Course objectives:** This course will enable students to
- Understand the frequency domain sampling and reconstruction of discrete time signals.
 - Study the properties and the development of efficient algorithms for the computation of DFT.
 - Realization of FIR and IIR filters in different structural forms.
 - Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
 - Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

Modules

Module-1	RBT Level
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution.	L1, L2
Module-2	
Additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).	L1, L2, L3
Module-3	
Radix-2 FFT algorithm for the computation of DFT and IDFT-decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.	L1, L2, L3
Module-4	
Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter - Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation.	L1, L2, L3
Module-5	
Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling	L1, L2,

structure, Lattice structure. FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows.	L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine response of LTI systems using time domain and DFT techniques. • Compute DFT of real and complex discrete time signals. • Computation of DFT using FFT algorithms and linear filtering approach. • Solve problems on digital filter design and realize using digital computations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003. 2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010. 3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007. 	

Verilog HDL
**B.E., V Semester, Electronics & Communication Engineering/
 Telecommunication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Differentiate between Verilog and VHDL descriptions. • Learn different Verilog HDL and VHDL constructs. • Familiarize the different levels of abstraction in Verilog. • Understand Verilog Tasks and Directives. • Understand timing and delay Simulation. • Learn VHDL at design levels of data flow, behavioral and structural for effective modeling of digital circuits. 			
Module-1			RBT Level
<p>Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text1)</p> <p>Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1)</p>			L1, L2, L3
Module-2			
<p>Basic Concepts Lexical conventions, data types, system tasks, compiler directives. (Text1)</p> <p>Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1)</p>			L1, L2, L3
Module-3			
<p>Gate-Level Modeling Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)</p> <p>Dataflow Modeling Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1)</p>			L1, L2, L3
Module-4			
<p>Behavioral Modeling Structured procedures, initial and always, blocking and non-blocking</p>			L1, L2, L3

statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. (Text1)	
Module-5	
<p>Introduction to VHDL Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis, Design tool flow, Font conventions. Entities and Architectures: Introduction, A simple design, Design entities, Identifiers, Data objects, Data types, and Attributes. (Text 2)</p>	L1, L2, L3
<p>Course Outcomes: At the end of this course, students should be able to</p> <ul style="list-style-type: none"> • Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction. • Write simple programs in VHDL in different styles. • Design and verify the functionality of digital circuit/system using test benches. • Identify the suitable Abstraction level for a particular digital design. • Write the programs more effectively using Verilog tasks and directives. • Perform timing and delay Simulation. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition. 2. Kevin Skahill, “VHDL for Programmable Logic”, PHI/Pearson education, 2006. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science+Business Media, LLC, Fifth edition. 2. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL” Pearson (Prentice Hall), Second edition. 3. Padmanabhan, Tripura Sundari, “Design through Verilog HDL”, Wiley, 2016 or earlier. 	

INFORMATION THEORY AND CODING
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to:

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

Modules

Module-1	RBT Level
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources (Section 4.1, 4.2 of Text 1).	L1, L2, L3
Module-2	
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2). Encoding of the Source Output, Shannon's Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1). Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm (Sections 3.6, 3.7, 3.8, 3.10 of Text 3).	L1, L2, L3
Module-3	
Information Channels: Communication Channels (Section 4.4 of Text 1). Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections 4.2, 4.3, 4.4, 4.6, 4.7 of Text 3).	L1, L2, L3
Module-4	

<p>Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array. Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1).</p>	L1, L2, L3
Module-5	
<p>Some Important Cyclic Codes: Golay Codes, BCH Codes(Section 8.4 - Article 5 of Text 2). Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5 - Articles 1,2 and 3, 8.6- Article 1 of Text 2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> • Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source • Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms • Model the continuous and discrete communication channels using input, output and joint probabilities • Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes • Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996. 2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008. 3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007 2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering 	

3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

OPERATING SYSTEM
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC553	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the services provided by an operating system. • Understand how processes are synchronized and scheduled. • Understand different approaches of memory management and virtual memory management. • Understand the structure and organization of the file system • Understand interprocess communication and deadlock situations. 			
Module-1			RBT Level
<p>Introduction to Operating Systems OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).</p>			L1, L2
Module-2			
<p>Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, 4.2, 4.3, 4.4.1 of Text).</p>			L1, L2
Module-3			
<p>Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies (Topics from Sections 5.5 to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1 of Text).</p>			L1, L2
Module-4			
<p>File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from Sections 7.1 to 7.8 of Text).</p>			L1, L2, L3
Module-5			
<p>Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Resource state modelling, Deadlock detection algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to</p>			L1, L2, L3

11.5 of Text).

Course outcomes: After studying this course, students will be able to:

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Book:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition, 2001.
2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

DSP Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL57	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory=03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).
6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
(ii) DFT computation of square pulse and Sinc function etc.
7. Design and implementation of FIR filter to meet given specifications (using different window techniques).
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

9. Linear convolution of two sequences
10. Circular convolution of two sequences
11. N-point DFT of a given sequence
12. Impulse response of first order and second order system
13. Implementation of FIR filter

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.

- Modelling of discrete time signals and systems and verification of its properties and results.
- Implementation of discrete computations using DSP processor and verify the results.
- Realize the digital filters using a simulation tool and a DSP processor and verify the frequency and phase response.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

HDL Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL58	IA Marks	20
Number of Lecture Hours/Week	01 Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

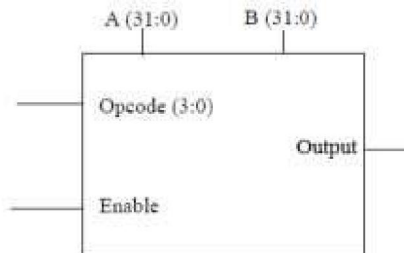
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesise the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

Part-A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer.
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
3. Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Write a Verilog code to model 32 bit ALU using the schematic diagram shown below



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU Operation
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

5. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
6. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters, using Verilog code.

Part-B: INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
3. Write HDL code to control speed, direction of DC and Stepper motor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.
6. Write HDL code to simulate Elevator operation.

Course Outcomes: At the end of this course, students should be able to:

- Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

Object Oriented Programming Using C++

B.E. V Semester (Open Elective)

[As per Choice Based Credit System (CBCS)scheme]

Subject Code	15EC562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs/ Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to: <ul style="list-style-type: none">• Define Encapsulation, Inheritance and Polymorphism.• Solve the problem with object oriented approach.• Analyze the problem statement and build object oriented system model.• Describe the characters and behavior of the objects that comprise a system.• Explain function overloading, operator overloading and virtual functions.• Discuss the advantages of object oriented programming over procedure oriented programming.			
Module -1			RBT Level
Beginning with C++ and its features: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from Ch -2,3 of Text).			L1, L2
Module -2			
Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions (Selected Topics from Chap-4,5 of Text).			L1, L2, L3
Module -3			
Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text).			L1, L2, L3
Module -4			
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).			L1, L2, L3

Module -5	
Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text).	L1, L2, L3
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Explain the basics of Object Oriented Programming concepts. • Apply the object initialization and destroy concept using constructors and destructors. • Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. • Use the concept of inheritance to reduce the length of code and evaluate the usefulness. • Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. • Use I/O operations and file streams in programs. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.</p> <p>Reference Book: Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.</p>	

B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours/Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

Module-1	RBT Level
<p>Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p>Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2)</p>	L1, L2, L3
Module-2	
<p>Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4).</p>	L1, L2, L3
Module-3	
<p>Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM (Relevant topics in Text 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK</p>	

<p>generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12, 7.13).</p>	
Module-4	
<p>Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI-The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol-by-Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2).</p> <p>Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).</p>	L1, L2, L3
Module-5	
<p>Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Associate and apply the concepts of Bandpass sampling to well specified signals and channels. • Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. • Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. • Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p>	

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books:

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.

ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering**
[As per Choice Based Credit System (CBCS) scheme]

<u>ARM MICROCONTROLLER & EMBEDDED SYSTEMS</u>			
B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none">• Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.• Program ARM Cortex M3 using the various instructions and C language for different applications.• Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.• Develop the hardware software co-design and firmware design approaches.• Explain the need of real time operating system for embedded system applications.			
Module-1			
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) L1, L2			
Module-2			
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) L1, L2, L3			
Module-3			
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. (Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). L1, L2, L3			
Module-4			
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded			

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).

(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues - Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment - Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques

(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

L1, L2, L3

Course outcomes: After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

VLSI Design
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Module-1	RBT Level
<p>Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).</p> <p>Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).</p>	L1, L2
Module-2	
<p>MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.</p> <p>Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).</p>	L1, L2, L3
Module-3	
<p>Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters</p> <p>Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).</p>	L1, L2, L3
Module-4	
<p>Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).</p> <p>FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture, Physical design for FPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3).</p>	L1, L2, L3
Module-5	
<p>Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).</p>	L1, L2, L3

Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).

Course outcomes: At the end of the course, the students will be able to:

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Interpret Memory elements along with timing considerations
- Demonstrate knowledge of FPGA based system design
- Interpret testing and testability issues in VLSI Design
- Analyze CMOS subsystems and architectural issues with the design constraints.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. **“Basic VLSI Design”**- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994).
2. **“CMOS VLSI Design- A Circuits and Systems Perspective”**- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3. **“FPGA Based System Design”**- Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

COMPUTER COMMUNICATION NETWORKS
B.E., VI Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

COMPUTER COMMUNICATION NETWORKS B.E., VI Semester, Electronics & Communication Engineering / Telecommunication Engineering [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the layering architecture of OSI reference model and TCP/IP protocol suite. • Understand the protocols associated with each layer. • Learn the different networking architectures and their representations. • Learn the various routing techniques and the transport layer services. 			
Module-1			
<p>Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet. Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. L1, L2</p>			
Module-2			
<p>Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing. Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. L1, L2</p>			
Module-3			
<p>Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers. Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages. Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing.</p>			

DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. **L1, L2**

Module-4

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging Tools, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. **L1, L2, L3**

Module-5

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. **L1, L2**

Course Outcomes: At the end of the course, the students will be able to:

- Identify the protocols and services of Data link layer.
- Identify the protocols and functions associated with the transport layer services.
- Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
- Distinguish the basic network configurations and standards associated with each network.
- Construct a network model and determine the routing of packets using different routing algorithms.

Text Book:

Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016
ISBN: 1-25-906475-3

Reference Books:

1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4
2. Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282

ARTIFICIAL NEURAL NETWORKS
B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC653	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: The objectives of this course are:</p> <ul style="list-style-type: none"> • Understand the basics of ANN and comparison with Human brain • Provide knowledge on Generalization and function approximation and various architectures of building an ANN • Provide knowledge of reinforcement learning using neural networks • Provide knowledge of unsupervised learning using neural networks. 			
Module-1			RBT Level
<p>Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.</p>			L1, L2
Module-2			
<p>Supervised Learning: Perceptron learning and Non Separable sets, -Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.</p>			L1, L2, L3
Module-3			
<p>Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.</p>			L1, L2, L3
Module-4			
<p>Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.</p>			L1, L2, L3
Module-5			
<p>Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.</p>			L1, L2, L3

Course outcomes: At the end of the course, students should be able to:

- Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
- Understand the concepts and techniques of neural networks through the study of the most important neural network models.
- Evaluate whether neural networks are appropriate to a particular application.
- Apply neural networks to particular applications, and to know what steps to take to improve performance.

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. **Introduction to Artificial Neural Systems**-J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks**-B. Yegnanarayana, PHI, New Delhi 1998.

**6th Semester Open Electives Syllabus for the courses offered by
EC/TC Board:**

DATA STRUCTURE USING C++ B.E VI Semester (Open Elective) [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC661	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs per Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Analyze Linear Data Structures: Stack, Queues, Lists • Analyze Non Linear Data Structures: Trees • Assess appropriate data structure during program development/Problem Solving 			
Module -1			
INTRODUCTION: Functions and parameters, Dynamic memory allocation, Recursion. LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. L1, L2			
Module -2			
ARRAYS AND MATRICES: Arrays, Matrices, Special matrices, Sparse matrices. STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Paranthesis Matching & Towers of Hanoi. L1, L2, L3			
Module -3			
QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement. HASHING: Dictionaries, Linear representation, Hash table representation. L1, L2, L3			
Module -4			
BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. L1, L2, L3			
Module -5			
Priority Queues: Linear lists, Heaps, Applications-Heap Sorting. Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates. L1, L2, L3			

Course outcomes: After studying this course, students will be able to:

- Acquire knowledge of Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
- Understand non Linear data structures trees and their applications
- Design appropriate data structures for solving computing problems
- Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++**, Sartaj Sahni, Mc. Graw Hill, 2000.
2. **Object Oriented Programming with C++**, E.Balaguruswamy, TMH, 6th Edition, 2013.
3. **Programming in C++**, E.Balaguruswamy. TMH, 4th, 2010.

EMBEDDED CONTROLLER LAB

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL67	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

Course outcomes: After studying this course, students will be able to:

- Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Conduction of Practical Examination:

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

COMPUTER NETWORKS LABORATORY
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL68	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
- Design a suitable network and simulate using a Network simulator tool.
- Simulate the networking concepts and protocols using C/C++ programming.
- Model the networks for different configurations and analyze the results.

Laboratory Experiments

PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
6. Implementation of Link state routing algorithm.

PART-B: Implement the following in C/C++

1. Write a program for a HDLC frame to perform the following.
 - i) Bit stuffing
 - ii) Character stuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.

3. Implement Dijkstra's algorithm to compute the shortest routing path.
4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
 - a. Without error
 - b. With error
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol
6. Write a program for congestion control using leaky bucket algorithm.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Use the network simulator for learning and practice of networking algorithms.
- Illustrate the operations of network protocols and algorithms using C programming.
- Simulate the network with different configurations to measure the performance parameters.
- Implement the data link and routing protocols using C programming.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination one question from software and one question from hardware or only one hardware experiments based on the complexity to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C SEVENTH SEMESTER SYLLABUS

MICROWAVES AND ANTENNAS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	15EC71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none">• Describe the microwave properties and its transmission media• Describe microwave devices for several applications• Understand the basics of antenna theory• Select antennas for specific applications			
Module-1			
Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2) Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) L1, L2			
Module-2			
Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3) Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) L1, L2			
Module-3			
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15) L1, L2, L3			

Module-4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (Text 3: 5.1 – 5.10, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of $\lambda/2$ Antenna. (Text 3: 6.1 – 6.6)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas. (Text 3: 7.1–7.8, 7.19, 7.20)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4th Special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.

DIGITAL IMAGE PROCESSING

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC72	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: The objectives of this course are to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of digital image processing • Understand the image transform used in digital image processing • Understand the image enhancement techniques used in digital image processing • Understand the image restoration techniques and methods used in digital image processing • Understand the Morphological Operations and Segmentation used in digital image processing 			
Module-1			RBT Level
<p>Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. [Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]</p>			L1, L2
Module-2			
<p>Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. [Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10]</p>			L1, L2, L3
Module-3			
<p>Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. [Text: Chapter 5: Sections 5.2, to 5.9]</p>			L1, L2, L3
Module-4			

<p>Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. [Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5]</p>	<p>L1, L2, L3</p>
<p>Module-5</p>	
<p>Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds. Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2]</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students should be able to:</p> <ul style="list-style-type: none"> • Understand image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of Image Enhancement techniques. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004. 	

POWER ELECTRONICS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

<u>POWER ELECTRONICS</u>			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC73	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none">• Understand the construction and working of various power devices.• Study and analysis of thyristor circuits with different triggering conditions.• Learn the applications of power devices in controlled rectifiers, converters and inverters.• Study of power electronics circuits under various load conditions.			
Module-1			
Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations. (Text 1) L1, L2			
Module-2			
Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation - Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) L1, L2, L3			
Module-3			
Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase controllers with resistive and inductive loads. (Text 1) L1, L2, L3			
Module-4			
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design. (Text 1) L1, L2			
Module-5			
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design. Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state			

relays, Microelectronic relays. (Text 1) **L1, L2**

Course Outcomes: At the end of the course students should be able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 05 marks out of 20 Internal Assessment (IA) Marks, reserved for the other activities.

Text Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

MULTIMEDIA COMMUNICATION

**B.E., VII Semester, Electronics & Communication Engineering/
Telecommunication Engineering**

[As per Choice Based credit System (CBCS) Scheme

Subject Code	15EC741	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours / Module)	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to:

- Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
- Understand digitization principle techniques required to analyze different media types.
- Analyze compression techniques required to compress text and image and gain knowledge of DMS.
- Analyze compression techniques required to compress audio and video.
- Gain fundamental knowledge about multimedia communication across different networks.

REAL TIME SYSTEMS

B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC743	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
Credits – 03			
<p>Course Objectives: This Course will enable students to:</p> <ul style="list-style-type: none"> • Discuss the historical background of Real-time systems and its classifications. • Describe the concepts of computer control and hardware components for Real-Time Application. • Discuss the languages to develop software for Real-Time Applications. • Explain the concepts of operating system and RTS development methodologies. 			
Modules			RBT Level
Module-1			
<p>Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.</p> <p>Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6)</p>			L1, L2
Module-2			
<p>Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8)</p>			L1, L2
Module-3			
<p>Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. (Text Book: 5.1 to 5.14)</p>			L1, L2, L3
Module-4			
<p>Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11)</p>			L1, L2

Module-5	
<p>Design of RTS - General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.</p> <p>RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hatley and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5)</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, students should be able to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of Real time systems and its classifications. • Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications. • Develop the software languages to meet Real time applications. • Apply suitable methodologies to design and develop Real-Time Systems. 	
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. C.M. Krishna, Kang G. Shin, "Real -Time Systems", McGraw -Hill International Editions, 1997. 2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005. 3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005. 	

DSP Algorithms and Architecture
B.E., VII Semester, Electronics & Communication Engineering
/Telecommunication Engineering
[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC751	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Figure out the knowledge and concepts of digital signal processing techniques. • Understand the computational building blocks of DSP processors and its speed issues. • Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor. • Learn how to interface the external devices to TMS320C54xx processor in various modes. • Understand basic DSP algorithms with their implementation. 			
Module-1			RBT Level
<p>Introduction to Digital Signal Processing: Introduction, A Digital Signal - Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.</p> <p>Computational Accuracy in DSP Implementations: Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation.</p>			L1, L2
Module-2			
<p>Architectures for Programmable Digital Signal - Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.</p>			L1, L2, L3
Module-3			
<p>Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54XX, Memory Space of TMS320C54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On - Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.</p>			L1, L2, L3
Module-4			

<p>Implementation of Basic DSP Algorithms: Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).</p> <p>Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS320C54xx.</p>	L1, L2, L3
Module-5	
<p>Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).</p> <p>Interfacing and Applications of DSP Processors: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.</p>	L1, L2, L3
<p>Course Outcomes: At the end of this course, students would be able to</p> <ul style="list-style-type: none"> • Comprehend the knowledge and concepts of digital signal processing techniques. • Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor. • Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. • Develop basic DSP algorithms using DSP processors. • Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device. • Demonstrate the programming of CODEC interfacing. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of Three sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: “Digital Signal Processing”, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Digital Signal Processing: A practical approach”, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002. 2. “Digital Signal Processors”, B Venkataramani and M Bhaskar, TMH, 2nd, 2010 3. “Architectures for Digital Signal Processing”, Peter Pirsch John Wiley, 2008 	

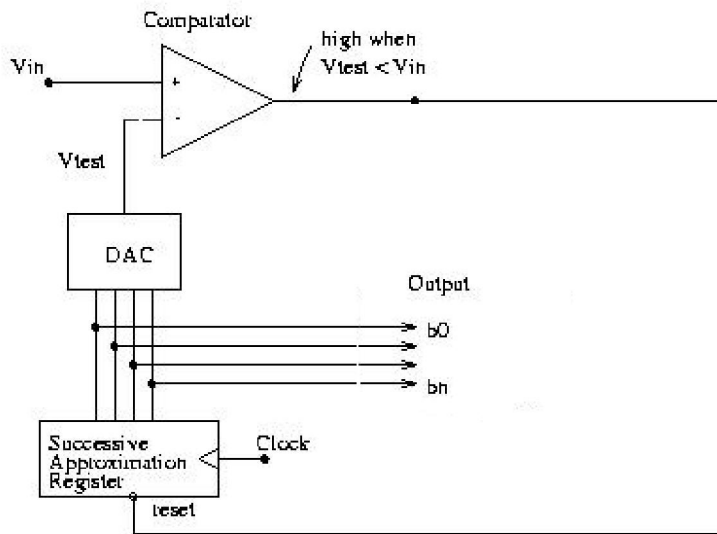
VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL77	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explore the CAD tool and understand the flow of the Full Custom IC design cycle. • Learn DRC, LVS and Parasitic Extraction of the various designs. • Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts. • Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts. 			
<p>Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind</p>			
Laboratory Experiments			
PART - A			
ASIC-DIGITAL DESIGN			
<p>1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.</p> <ol style="list-style-type: none"> i. An inverter ii. A Buffer iii. Transmission Gate iv. Basic/universal gates v. Flip flop -RS, D, JK, MS, T vi. Serial & Parallel adder vii. 4-bit counter [Synchronous and Asynchronous counter] viii. Successive approximation register [SAR] 			

PART - B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.
[Specifications to GDS-II]



* An appropriate constraint should be given.

** Appropriate specification should be given.

*** Applicable Library should be added & information should be given to the Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C EIGHTH SEMESTER SYLLABUS

Wireless Cellular and LTE 4G Broadband

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC81	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the basics of LTE standardization phases and specifications. • Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles. • Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. • Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth. 			
Module - 1			RBT Level
<p>Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).</p> <p>Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC - Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 - 2.7 of Text).</p>			L1, L2
Module - 2			
<p>Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 - 3.6 of Text).</p> <p>OFDMA and SC-FDMA: OFDM with FDMA, TDMA, CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 - 4.3, 4.5 of Text).</p> <p>Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 - 5.6 of Text).</p>			L1, L2
Module - 3			
<p>Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink</p>			L1, L2

SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).	
Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text).	
Module - 4	
Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).	L1, L2
Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text).	
Module - 5	
Radio Resource Management and Mobility Management: PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination(Sec 10.1 – 10.5 of Text).	L1, L2
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Understand the system architecture and the functional standard specified in LTE 4G. • Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. • Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. • Test and Evaluate the Performance of resource management and packet data processing and transport algorithms. 	
Question Paper pattern:	
<ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
Text Book:	
Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.	

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
3. 'LTE - The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

FIBER OPTICS and NETWORKS
B.E., VIII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS)]

Subject Code	15EC82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn the basic principle of optical fiber communication with different modes of light propagation. • Understand the transmission characteristics and losses in optical fiber. • Study of optical components and its applications in optical communication networks. • Learn the network standards in optical fiber and understand the network architectures along with its functionalities. 			
Module -1			RBT Level
<p>Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2)</p>			L1, L2
Module -2			
<p>Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p>Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2)</p>			L1, L2
Module -3			
<p>Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.</p> <p>Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.</p> <p>Optical Receiver: Optical Receiver Operation: Error sources,</p>			L1, L2

Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1)	
Module -4	
<p>WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,</p> <p>Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1)</p>	L1, L2
Module -5	
<p>Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropolitan area networks, Access networks, Local area networks. (Text 2)</p>	L1, L2
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Classification and working of optical fiber with different modes of signal propagation. 2. Describe the transmission characteristics and losses in optical fiber communication. 3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers. 4. Describe the constructional features and the characteristics of optical sources and detectors. 5. Illustrate the networking aspects of optical fiber and describe various standards associated with it. 	
<p>Question Paper pattern:</p> <ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gerd Keiser , Optical Fiber Communication, 5th Edition, McGraw Hill 	

Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd
Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Book:

Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005,
ISBN:0130085103

Radar Engineering			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15EC833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the Radar fundamentals and analyze the radar signals. • Understand various technologies involved in the design of radar transmitters and receivers. • Learn various radars like MTI, Doppler and tracking radars and their comparison 			
Modules			RBT Level
Module-1			
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation , Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text)			L1, L2, L3
Module-2			
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)			L1, L2, L3
Module-3			
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)			L1, L2, L3
Module-4			
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse. Sequential Lobing , Conical Scan Tracking, Block Diagram of Conical Scan			L1, L2, L3

Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text)	
Module-5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (Chapter 9: 9.1, 9.2 9.4, 9.5 of Text) Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)	L1, L2, L3
Course outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> • Understand the radar fundamentals and radar signals. • Explain the working principle of pulse Doppler radars, their applications and limitations • Describe the working of various radar transmitters and receivers. • Analyze the range parameters of pulse radar system which affect the system performance 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.	
Reference Books: <ol style="list-style-type: none"> 1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004. 2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998. 3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. Holm. Yesdee, 2013 	

SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics -III*	04		03	80	20	100	4
2	15EC32	Analog Electronics	04		03	80	20	100	4
3	15EC33	Digital Electronics	04		03	80	20	100	4
4	15EC34	Network Analysis	04		03	80	20	100	4
5	15EC35	Electronic Instrumentation	04		03	80	20	100	4
6	15EC36	Engineering Electromagnetics	04		03	80	20	100	4
7	15ECL37	Analog Electronics Lab		1I+2P	03	80	20	100	2
8	15ECL38	Digital Electronics Lab		1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP31	Additional Mathematics - I	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical / Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT41	Engineering Mathematics -IV*	04		03	80	20	100	4
2	15EC42	Microprocessor	04		03	80	20	100	4
3	15EC43	Control Systems	04		03	80	20	100	4
4	15EC44	Signals and Systems	04		03	80	20	100	4
5	15EC45	Principles of Communication Systems	04		03	80	20	100	4
6	15EC46	Linear Integrated Circuits	04		03	80	20	100	4
7	15ECL47	Microprocessor Lab		11+2P	03	80	20	100	2
8	15ECL48	Linear ICs and Communication Lab		11+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

*Additional course for Lateral entry students only:

1	15MATDIP41	Additional Mathematics - II	03		03	80	--	80	--
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SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical /Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15ES51	Management and Entrepreneurship Development	04		03	80	20	100	4
2	15EC52	Digital Signal Processing	04		03	80	20	100	4
3	15EC53	Verilog HDL	04		03	80	20	100	4
4	15EC54	Information Theory & Coding	04		03	80	20	100	4
5	15EC55X	Professional Elective-1	03		03	80	20	100	3
6	15EC56X	Open Elective-1	03		03	80	20	100	3
7	15ECL57	DSP Lab		11+2P	03	80	20	100	2
8	15ECL58	HDL Lab		11+2P	03	80	20	100	2
TOTAL			22	06	24	640	160	800	26

Professional Elective-1		Open Elective-1	
15EC553	Operating System	15EC562	Object Oriented Programming in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks		Total Marks
1	15EC61	Digital Communication	04		03	80	20	100	4
2	15EC62	ARM Microcontroller & Embedded Systems	04		03	80	20	100	4
3	15EC63	VLSI Design	04		03	80	20	100	4
4	15EC64	Computer Communication Networks	04		03	80	20	100	4
5	15EC65X	Professional Elective-2	03		03	80	20	100	3
6	15EC66X	Open Elective-2	03		03	80	20	100	3
7	15ECL67	Embedded Controller Lab		1I+2P	03	80	20	100	2
8	15ECL68	Computer Networks Lab		1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective-2		Open Elective-2	
15EC653	Artificial Neural Network	15EC661	Data Structures in C++

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			15EC	
			Theory	Practical/Drawing	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	15EC71	Microwave and Antennas	04		03	20	80	100	4
2	15EC72	Digital Image Processing	04		03	20	80	100	4
3	15EC73	Power Electronics	04		03	20	80	100	4
4	15XX74X	Professional Elective-3	03		03	20	80	100	3
5	15EC75X	Professional Elective-4	03		03	20	80	100	3
6	15ECL76	Advanced Communication Lab		1I+2P	03	20	80	100	2
7	15ECL77	VLSI Lab		1I+2P	03	20	80	100	2
8	15ECP78	Project Work Phase-I + Project work Seminar		03		100	-	100	2
TOTAL			18	09	21	240	560	800	24

Professional Elective-3		Professional Elective-4	
15EC743	Real Time System	15EC751	DSP algorithms & Architecture

SCHEME OF TEACHING AND EXAMINATION
B.E.: Electronics & Communication Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EC81	Wireless Cellular and LTE 4G Broadband	4	-	3	20	80	100	4
2	15EC82	Fiber Optics & Networks	4	-	3	20	80	100	4
3	15EC83X	Professional Elective-5	3	-	3	20	80	100	3
4	15EC84	Internship/Professional Practice	Industry Oriented		3	50	50	100	2
5	15ECP85	Project Work	-	6	3	100	100	200	6
6	15ECS86	Seminar	-	4	-	100	-	100	1
TOTAL			11	10	15	310	390	700	20

Professional Elective-5	
15EC833	RADAR Engg.

**B.E., III Semester, Electronics & Communication Engineering
/Telecommunication Engineering**

ENGINEERING MATHEMATICS-III B.E., III Semester, Common to all Branches [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Introduce most commonly used analytical and numerical methods in the different engineering fields. • Learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods. • Solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Modules			RBT Level
Module-1			
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			L1, L2, L4
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			L2, L3, L4
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) -Problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.			L3
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof)-Problems.			L3

Module-5	
<p>Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems.</p> <p>Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems.</p>	<p>L3, L4</p> <p>L2, L4</p>
<p>Course outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functionals and solve the simple problems of the calculus of variations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i> 2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
<p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - I
B.E., III Semester, Common to all Branches
(A Bridge course for Lateral Entry students of III Sem. B. E.)
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15MATDIP31	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation. • Solve first order differential equations. 			
Modules			RBT Level
Module-1			
<p>Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).</p> <p>Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems.</p>			L1
Module-2			
<p>Differential Calculus: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Leibnitz's theorem (without proof). Polar curves-angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application to Jacobians.</p>			L1, L2
Module-3			
<p>Integral Calculus: Statement of reduction formulae for $\sin^n x$, $\cos^n x$, and $\sin^m x \cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.</p>			L1, L2
Module-4			
<p>Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.</p>			L1, L2
Module-5			
<p>Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types.</p>			L1, L2

<p>Course outcomes: On completion of the course, students are able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in related area. • Use derivatives and partial derivatives to calculate rates of change of multivariate functions. • Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region. • Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions. • Recognize and solve first-order ordinary differential equations occurring in different branches of engineering. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.</i> 	

ANALOG ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain various BJT parameters, connections and configurations. • Explain BJT Amplifier, Hybrid Equivalent and Hybrid Models. • Explain construction and characteristics of JFETs and MOSFETs. • Explain various types of FET biasing, and demonstrate the use of FET amplifiers. • Construct frequency response of BJT and FET amplifiers at various frequencies. • Analyze Power amplifier circuits in different modes of operation. • Construct Feedback and Oscillator circuits using FET. 			
Modules			RBT Level
Module -1			
<p>BJT AC Analysis: BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid Model.</p>			L1, L2,L3
Module -2			
<p>Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.</p> <p>FET Amplifiers: JFET small signal model, Fixed bias configuration, Self bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.</p>			L1, L2, L3
Module -3			
<p>BJT and JFET Frequency Response: Logarithms, Decibels, Low frequency response - BJT Amplifier with RL, Low frequency response-FET Amplifier, Miller effect capacitance, High frequency response - BJT Amplifier, High frequency response-FET Amplifier, Multistage Frequency Effects.</p>			L1, L2, L3
Module -4			

<p>Feedback and Oscillator Circuits: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wien bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Power Amplifiers: Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers. Voltage Regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers. • Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT. • Calculate the AC gain and impedance for BJT using re and h parameters models for CE and CC configuration. • Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model. • Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics. • Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Robert L. Boylestad and Louis Nashelsky, “Electronics devices and Circuit theory”, Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Adel S. Sedra and Kenneth C. Smith, “Micro Electronic Circuits Theory and Application”, 5th Edition ISBN:0198062257 2. Fundamentals of Microelectronics, Behzad Razavi, John Wiley ISBN 2013 978-81-265-2307-8 3. J.Millman & C.C.Halkias Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424. 	

DIGITAL ELECTRONICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques. • Design combinational logic circuits. • Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators. • Describe Latches and Flip-flops, Registers and Counters. • Analyze Mealy and Moore Models. • Develop state diagrams Synchronous Sequential Circuits. 			
Modules			RBT Level
Module - 1			
<p>Principles of combination logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables.(Text 1, Chapter 3)</p>			L1, L2, L3
Module -2			
<p>Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.(Text 1, Chapter 4)</p>			L1, L2, L3
Module -3			
<p>Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops,JK flip-flops, Edge triggered flip-flops, Characteristic equations. (Text 2, Chapter 6)</p>			L1,L2
Module -4			
<p>Simple Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counters, Design of a synchronous mod-n counter using clocked T , JK , D and SR flip-flops. (Text 2, Chapter 6)</p>			L1,L2, L3

Module -5	
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. (Text 1, Chapter 6)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques. • Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators. • Explain the working of Latches and Flip Flops (SR,D,T and JK). • Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops. • Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. • Apply the knowledge gained in the design of Counters and Registers. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1. 2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002. ISBN 978-0-07-052906-9. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. D. P. Kothari and J. S Dhillon, “Digital Circuits and Design”, Pearson, 2016, ISBN:9789332543539. 2. Morris Mano, “Digital Design”, Prentice Hall of India, Third Edition. 3. Charles H Roth, Jr., “Fundamentals of logic design”, Cengage Learning. 4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424. 	

NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC34	IA Marks	20
Number	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course enables students to:</p> <ul style="list-style-type: none"> • Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power. • Explain network Thevenin's, Millman's, Superposition, Reciprocity, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits. • Explain the behavior of networks subjected to transient conditions. • Use applications of Laplace transforms to network problems. • Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response. • Study two port network parameters like Z, Y, T and h and their inter-relationships and applications. 			
Modules			RBT Level
Module -1			
Basic Concepts: Practical sources, Source transformations, Network reduction using Star - Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.			L1, L2,L3,L4
Module -2			
Network Theorems: Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem.			L1, L2, L3,L4
Module -3			
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.			L1, L2, L3,L4
Module -4			
Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q-Factor, Bandwidth.			L1, L2, L3,L4
Module -5			

<p>Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets.</p>	<p>L1, L2, L3,L4</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting. • Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions. • Calculate current and voltages for the given circuit under transient conditions. • Apply Laplace transform to solve the given network. • Evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits • Solve the given network using specified two port network parameter like Z or Y or T or h. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958. 2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010. 2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8thed, 2006. 3. Charles K Alexander and Mathew N O Sadiku, " Fundamentals of Electric Circuits", Tata McGraw-Hill, 3rd Ed, 2009. 	

ELECTRONIC INSTRUMENTATION [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define and describe accuracy and precision, types of errors, statistical and probability analysis. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of various Analog and Digital measuring instruments. • Describe basic concepts and operation of Digital Voltmeters and Microprocessor based instruments. • Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges. • Recognize and describe significance and working of different types of transducers. 			
Modules			RBT Level
<p>Module -1 Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations, Basics of Statistical Analysis. (Text 2)</p> <p>Ammeters: DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)</p> <p>Voltmeters and Multimeters: Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. Transistor Voltmeter, Differential Voltmeter, True RMS Voltmeter, Considerations in Choosing an Analog Voltmeter, Multimeter. (Text 1)</p>			L1, L2, L3
Module -2			

<p>Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Continuous Balance DVM, $3\frac{1}{2}$-Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, Microprocessor based Ramp type DVM. (Text 1)</p> <p>Digital Instruments: Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, Microprocessor based Instruments. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -3</p>	
<p>Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Storage Oscilloscope, Digital Readout Oscilloscope, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)</p> <p>Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, Square and Pulse Generator, Sweep Generator. (Text 1)</p>	<p>L1, L2</p>
<p>Module -4</p>	
<p>Measuring Instruments: Output Power Meters, Field Strength Meter, Stroboscope, Phase Meter, Vector Impedance Meter, Q Meter, Megger, Analog pH Meter. (Text 1)</p> <p>Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge, Wagner's earth connection. (Text 1)</p>	<p>L1, L2,L3</p>
<p>Module -5</p>	
<p>Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Differential output transducers, LVDT, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Semiconductor photo diode and transistor, Temperature transducers-RTD. (Text 1)</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Describe instrument measurement errors and calculate them. • Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters. • Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions. • Describe functional concepts and operation of various Analog measuring instruments to measure output power, field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance and pH. • Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers. • Utilize AC and DC bridges for passive component and frequency measurements. 	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.

Reference Books:

1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN:9789332556065.
2. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai & Sons. ISBN -81-7700-016-0

ENGINEERING ELECTROMAGNETICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Subject Code	15EC36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient. • Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions. • Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions. • Infer the effects of magnetic forces, materials and inductance. • Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behaviour in different media • Acquire knowledge of Poynting theorem and its application of power flow. 			
Modules		RBT Level	
Module - 1			
Coulomb's Law, Electric Field Intensity and Flux density Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density.		L1, L2, L3	
Module -2			
Gauss's law and Divergence Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem. Energy, Potential and Conductors Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current.		L1, L2, L3	
Module -3			
Poisson's and Laplace's Equations Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation. Steady Magnetic Field Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials.		L1, L2, L3	
Module -4			

<p>Magnetic Forces Force on a moving charge, differential current elements, Force between differential current elements.</p> <p>Magnetic Materials Magnetisation and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials.</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Time-varying fields and Maxwell's equations Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.</p> <p>Uniform Plane Wave Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. • Determine potential and energy with respect to point charge and capacitance using Laplace equation. • Calculate magnetic field, force, and potential energy with respect to magnetic materials. • Apply Maxwell's equation for time varying fields, EM waves in free space and conductors. • Evaluate power associated with EM waves using Poynting theorem. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2009, ISBN-978-0-07-061223-5.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. John Krauss and Daniel A Fleisch, " Electromagnetics with applications", McGraw-Hill. 2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson. 	

ANALOG ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL37	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:</p> <ul style="list-style-type: none"> • Rectifiers and Voltage Regulators. • BJT characteristics and Amplifiers. • JFET Characteristics and Amplifiers. • MOSFET Characteristics and Amplifiers • Power Amplifiers. • RC-Phase shift, Hartley, Colpitts and Crystal Oscillators. 			
NOTE: The experiments are to be carried using discrete components only.			
Laboratory Experiments:			
1. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency: (a) Full Wave Rectifier (b) Bridge Rectifier			
2. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).			
3. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.			
4. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.			
5. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.			
6. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.			
7. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.			

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
10. Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
11. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
12. Design and set-up the crystal oscillator and determine the frequency of oscillation.
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators. • Determine the characteristics of BJT and FET amplifiers and plot its frequency response. • Compute the performance parameters of amplifiers and voltage regulators • Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

DIGITAL ELECTRONICS LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER - III (EC/TC)			
Laboratory Code	15ECL38	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Mark	80
RBT Level	L1, L2, L3	Exam Hour	03
CREDITS - 02			
<p>Course objectives: This laboratory course enables students to get practical experience in design, realisation and verification of</p> <ul style="list-style-type: none"> • Demorgan's Theorem, SOP, POS forms • Full/Parallel Adders, Subtractors and Magnitude Comparator • Multiplexer using logic gates • Demultiplexers and Decoders • Flip-Flops, Shift registers and Counters 			
<p>NOTE:</p> <ol style="list-style-type: none"> 1. Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used. 2. For experiment No. 11 and 12 any open source or licensed simulation tool may be used. 			
Laboratory Experiments:			
1. Verify			
(a) Demorgan's Theorem for 2 variables.			
(b) The sum-of product and product-of-sum expressions using universal gates.			
2. Design and implement			
(a) Full Adder using basic logic gates.			
(b) Full subtractor using basic logic gates.			
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.			
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.			
5. Realize			
(a) 4:1 Multiplexer using gates.			
(b) 3-variable function using IC 74151(8:1MUX).			
6. Realize 1:8 Demux and 3:8 Decoder using IC74138.			
7. Realize the following flip-flops using NAND Gates.			
(a) Clocked SR Flip-Flop (b) JK Flip-Flop.			
8. Realize the following shift registers using IC7474			
(a) SISO (b) SIPO (c) PISO (d) PIPO.			
9. Realize the Ring Counter and Johnson Counter using IC7476.			
10. Realize the Mod-N Counter using IC7490.			

11. Simulate Full- Adder using simulation tool.

12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.
- Construct and test flips-flops, counters and shift registers.
- Simulate full adder and up/down counters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B.E E&C FOURTH SEMESTER SYLLABUS

ENGINEERING MATHEMATICS-IV			
B.E., IV Semester, Common to all Branches			
[As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)		
Credits - 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. 			
Modules			RBT Level
Module-1			
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae).			L1, L3
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method.			L3
Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$ -Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue's formula, problems.			
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems.			L1, L3,
Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z+(1/z)(z \neq 0)$ and bilinear transformations-problems.			L3
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.			L3

<p>Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.</p>	
<p>Module-5</p>	
<p>Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.</p>	<p>L3</p>
<p>Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.</p>	<p>L1</p>
<p>Course Outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods. • Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory. • Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing. • Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems. • Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering. • Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis. • Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events. • Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books: <i>1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	

<p>2. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.</i> 2. <i>B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.</i> 3. <i>H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.</i> 	
<p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 	

ADDITIONAL MATHEMATICS - II
B.E., IV Semester, Common to all Branches
(A Bridge course for Lateral Entry students of IV Sem. B. E.)
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15MATDIP41	IA Marks	--
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)		
Credits – 00			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand essential concepts of linear algebra. • Solve second and higher order differential equations. • Understand Laplace and inverse Laplace transforms and elementary probability theory. 			
Modules			RBT Level
Module-1			
<p>Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.</p>			L1,L3
Module-2			
<p>Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of undetermined coefficients and variation of parameters.</p>			L1,L3
Module-3			
<p>Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only.</p>			L1,L2
Module-4			
<p>Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Application to solutions of Linear differential equations and simultaneous differential equations.</p>			L1,L2
Module-5			
<p>Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples.</p>			L1,L2
<p>Course Outcomes: On completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Solve systems of linear equations in the different areas of linear algebra. • Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations. 			

<ul style="list-style-type: none"> • Describe Laplace transforms of standard and periodic functions. • Determine the general/complete solutions to linear ODE using inverse Laplace transforms. • Recall basic concepts of elementary probability theory and, solve problems related to the decision theory, synthesis and optimization of digital circuits. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: <i>B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^d Ed., 2015.</i></p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. <i>E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10^h Ed., 2015.</i> 2. <i>N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7^h Ed., 2007.</i> 	

MICROPROCESSORS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Familiarize basic architecture of 8086 microprocessor • Program 8086 Microprocessor using Assembly Level Language • Use Macros and Procedures in 8086 Programs • Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design • Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures 			
Modules			RBT Level
Module -1			
<p>8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text).</p> <p>Addressing modes, Machine language instruction formats, Machine coding the program (2.2, 2.1, 3.2 of Text).</p> <p>INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text).</p>			L1, L2, L3
Module -2			
<p>Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text).</p>			L1, L2, L3
Module -3			
<p>Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Passing parameters to procedures, Macros, Timing and Delays. (Chap. 4 of Text).</p>			L1, L2, L3
Module -4			

<p>8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).</p> <p>Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255 (Refer 5.3, 5.4, 5.5 of Text).</p>	<p>L1, L2, L3</p>
<p>Module 5</p>	
<p>Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes (refer 6.1 of Text).</p> <p>INT 21H DOS Function calls - for handling Keyboard and Display (refer Appendix-B of Text).</p> <p>Other Architectures: Architecture of 8088 (refer 1.10 upto 1.10.1 of Text) and Architecture of NDP 8087 (refer 8.3.1, 8.3.5 of Text).</p> <p>Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students will be able to:</p> <ul style="list-style-type: none"> • Explain the History of evaluation of Microprocessors, Architecture and instruction set of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086. • Write 8086 Assembly level programs using the 8086 instruction set • Write modular programs using procedures and macros. • Write 8086 Stack and Interrupts programming • Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors. • Use INT 21 DOS interrupt function calls to handle Keyboard and Display. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Book:

Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. **Microcomputer systems-The 8086 / 8088 Family** - Y.C. Liu and A. Gibson, 2nd edition, PHI -2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** - Kenneth J Ayala, CENGAGE Learning, 2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

CONTROL SYSTEMS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER - IV (EC/TC)			
Subject Code	15EC43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the basic features, configurations and application of control systems. • Understand various terminologies and definitions for the control systems. • Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems. • Know how to find time response from the transfer function. • Find the transfer function via Masons' rule. • Analyze the stability of a system from the transfer function. 			
Modules			RBT Level
Module -1			
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems - Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.			L1, L2, L3
Module -2			
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).			L1, L2, L3
Module -3			
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.			L1, L2, L3
Module -4			

<p>Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).</p>	<p>L1, L2, L3</p>
<p>Module -5</p>	
<p>Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalisation.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, the students will be able to</p> <ul style="list-style-type: none"> • Develop the mathematical model of mechanical and electrical systems • Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method • Determine the time domain specifications for first and second order systems • Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. • Determine the stability of a system in the frequency domain using Nyquist and bode plots • Develop a control system model in continuous and discrete time using state variable techniques 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: J.Nagarath and M.Gopal, “ Control Systems Engineering”, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Modern Control Engineering,” K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7. 2. “Automatic Control Systems”, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 3. “Feedback and Control System,” Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007. 	

SIGNALS AND SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the mathematical description of continuous and discrete time signals and systems. • Analyze the signals in time domain using convolution difference/differential equations • Classify signals into different categories based on their properties. • Analyze Linear Time Invariant (LTI) systems in time and transform domains. • Build basics for understanding of courses such as signal processing, control system and communication. 			
Modules			RBT Level
Module -1			
<p>Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.</p> <p>Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.</p> <p>Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.</p> <p>Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.</p>			L1, L2, L3
Module -2			
<p>Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.</p>			L1, L2, L3
Module -3			

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours). Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours).	L1, L2, L3
Module -4	
Fourier Representation of aperiodic Signals: FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours). FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours). Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours).	L1, L2, L3
Module -5	
Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems.	L1, L2, L3
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals. • Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems. • Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. • Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis. • Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems. 	
Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book:	
Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.	

Reference Books:

1. **Michael Roberts**, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan**, "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.

PRINCIPLES OF COMMUNICATION SYSTEMS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals. • Understand the concepts in Angle modulation for the design of communication systems. • Design simple systems for generating and demodulating frequency modulated signals. • Learn the concepts of random process and various types of noise. • Evaluate the performance of the communication system in presence of noise. • Analyze pulse modulation and sampling techniques. 			
Modules			RBT Level
Module - 1			
<p>AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency - Domain description, Switching modulator, Envelop detector.</p> <p>DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency - Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.</p> <p>SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text).</p>			L1, L2, L3
Module - 2			
<p>ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text).</p>			L1, L2, L3
Module - 3			

<p>RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions (refer Chapter 5 of Text).</p> <p>NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 4</p>	
<p>NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text).</p>	<p>L1, L2, L3</p>
<p>Module - 5</p>	
<p>DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1).</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Determine the performance of analog modulation schemes in time and frequency domains. • Determine the performance of systems for generation and detection of modulated analog signals. • Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms. • Characterize the influence of channel on analog modulated signals • Determine the performance of analog communication systems. • Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Communication Systems, Simon Haykins & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 - 81 - 265 - 2151 - 7.</p>	
<p>Reference Books:</p>	

1. **Modern Digital and Analog Communication Systems**, B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems: Analog and Digital**, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

LINEAR INTEGRATED CIRCUITS [As per Choice Based Credit System (CBCS) scheme] SEMESTER - IV (EC/TC)			
Subject Code	15EC46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Define and describe various parameters of Op-Amp, its characteristics and specifications. • Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits. • Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters. • Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate. • Describe and Sketch the various switching circuits of Op-Amps and analyze its operations. • Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs. 			
Modules			RBT Level
Module -1			
Operational Amplifier Fundamentals: Basic Op-amp circuit, Op-Amp parameters - Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. OP-Amps as DC Amplifiers - Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet.(Text1)			L1, L2,L3
Module -2			
Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance - Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance - Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.(Text1)			L1, L2,L3
Module-3			
More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider. (Text2)			L1, L2,L3

Module -4	
<p>Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. (Text 1) Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. (Text 2)</p>	L1, L2,L3
Module -5	
<p>Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. (Text 2)</p>	L1, L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. • Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. • Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. • Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. • Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. • Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. "Operational Amplifiers and Linear IC's", David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9. 2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4thedition, Reprint 2006, New Age International ISBN 978-81-224-3098-1. 	

Reference Books:

1. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, "Linear Integrated Circuits: Analysis, Design & Applications," Wiley India, 1st Edition, 2015.
3. James Cox, "Linear Electronics Circuits and Devices", Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.

MICROPROCESSOR LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL47	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:

- i) Byte and word data transfer in different addressing Modes
- ii) Block move (with and without overlap)
- iii) Block interchange

2. Programs involving:

Arithmetic & logical operations like:

- i) Addition and Subtraction of multi precision nos.
- ii) Multiplication and Division of signed and unsigned Hexadecimal nos.
- iii) ASCII adjustment instructions.
- iv) Code conversions.

3. Programs involving:

Bit manipulation instructions like checking:

- i) Whether given data is positive or negative
- ii) Whether given data is odd or even
- iii) Logical 1's and 0's in a given data
- iv) 2 out 5 code
- v) Bit wise and nibble wise palindrome

4. Programs involving:

Branch/ Loop instructions like

- i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
- ii) Two application programs using Procedures and Macros (Subroutines).

<p>5. Programs involving</p> <p>String manipulation like string transfer, string reversing, searching for a string.</p>
<p>6. Programs involving</p> <p>Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.</p>
<p>7. Interfacing Experiments:</p> <p>Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)</p> <ol style="list-style-type: none"> 1. Matrix keyboard interfacing 2. Seven segment display interface 3. Logical controller interface 4. Stepper motor interface 5. ADC and DAC Interface (8 bit) 6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. • Understand assembler directives, branch, loop operations and DOS 21H Interrupts. • Write and execute 8086 assembly level programs to sort and search elements in a given array. • Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. • Utilize procedures and macros in programming 8086. • Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one question from software and one question from hardware interfacing to be set. • Students are allowed to pick one experiment from the lot. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

LINEAR ICS AND COMMUNICATION LAB

As per Choice Based Credit System (CBCS) scheme]

SEMESTER - IV (EC/TC)

Laboratory Code	15ECL48	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This laboratory course enables students to:

- Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp
- Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations.
- Design, Demonstrate and Analyze balance modulation and frequency synthesis.
- Demonstrate and Analyze pulse sampling and flat top sampling.

Laboratory Experiments:

1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.
3. Design active second order Butterworth low pass and high pass filters.
4. Design 4 bit R - 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
5. Design Adder, Integrator and Differentiator using Op-Amp.
6. Design of Monostable and Astable Multivibrator using 555 Timer.
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.
8. Amplitude modulation using transistor/FET (Generation and detection).
9. Frequency modulation using IC 8038/2206 and demodulation.
10. Design BJT/FET Mixer.
11. DSBSC generation using Balance Modulator IC 1496/1596.
12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C FIFTH SEMESTER SYLLABUS

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

B.E., V Semester, EC/TC/EI/BM/ML

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ES51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: This course will enable students to:

- Understand basic skills of Management
- Understand the need for Entrepreneurs and their skills
- Understand Project identification and Selection
- Identify the Management functions and Social responsibilities
- Distinguish between management and administration

Module-1	RBT Level
<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).</p> <p>Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making(Selected topics from Chapters 4 & 5, Text 1).</p>	L1, L2
Module-2	
<p>Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees-Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11,Text 1).</p> <p>Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow’s Need-Hierarchy Theory and Herzberg’s Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process (Selected topics from Chapters 15 to 18 and 9, Text 1).</p>	L1, L2
Module-3	
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).</p>	L1, L2

<p>Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship (Selected topics from Chapter 2, Text 2).</p>	
Module-4	
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only)(Selected topics from Chapter1, Text 2).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics from Chapter 4, Text 2).</p>	L1, L2
Module-5	
<p>Projects Management: AProject. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.</p> <p>Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.</p> <p>(Selected topics from Chapters 16 to 20 of Unit 3, Text 3).</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the fundamental concepts of Management and Entrepreneurship • Select a best Entrepreneurship model for the required domain of establishment • Describe the functions of Managers, Entrepreneurs and their social responsibilities • Compare various types of Entrepreneurs • Analyze the Institutional support by various state and central government agencies 	
<p>Question paper pattern</p> <ul style="list-style-type: none"> • The question paper will have TEN questions. • Each full question carries 16 marks. • There will be two full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

Reference Book:

Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

DIGITAL SIGNAL PROCESSING

B.E., V Semester, Electronics & Communication Engineering / Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

Modules

Module-1	RBT Level
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution.	L1, L2
Module-2	
Additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms).	L1, L2, L3
Module-3	
Radix-2 FFT algorithm for the computation of DFT and IDFT-decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform.	L1, L2, L3
Module-4	
Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation.	L1, L2, L3
Module-5	
Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling	L1, L2,

structure, Lattice structure. FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows.	L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Determine response of LTI systems using time domain and DFT techniques. • Compute DFT of real and complex discrete time signals. • Computation of DFT using FFT algorithms and linear filtering approach. • Solve problems on digital filter design and realize using digital computations. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003. 2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010. 3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007. 	

Verilog HDL
**B.E., V Semester, Electronics & Communication Engineering/
Telecommunication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Differentiate between Verilog and VHDL descriptions. • Learn different Verilog HDL and VHDL constructs. • Familiarize the different levels of abstraction in Verilog. • Understand Verilog Tasks and Directives. • Understand timing and delay Simulation. • Learn VHDL at design levels of data flow, behavioral and structural for effective modeling of digital circuits. 			
Module-1			RBT Level
<p>Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text1)</p> <p>Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1)</p>			L1, L2, L3
Module-2			
<p>Basic Concepts Lexical conventions, data types, system tasks, compiler directives. (Text1)</p> <p>Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1)</p>			L1, L2, L3
Module-3			
<p>Gate-Level Modeling Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)</p> <p>Dataflow Modeling Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1)</p>			L1, L2, L3
Module-4			
<p>Behavioral Modeling Structured procedures, initial and always, blocking and non-blocking</p>			L1, L2, L3

statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. (Text1)	
Module-5	
Introduction to VHDL Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis, Design tool flow, Font conventions. Entities and Architectures: Introduction, A simple design, Design entities, Identifiers, Data objects, Data types, and Attributes. (Text 2)	L1, L2, L3
Course Outcomes: At the end of this course, students should be able to <ul style="list-style-type: none"> • Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction. • Write simple programs in VHDL in different styles. • Design and verify the functionality of digital circuit/system using test benches. • Identify the suitable Abstraction level for a particular digital design. • Write the programs more effectively using Verilog tasks and directives. • Perform timing and delay Simulation. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
Text Books: <ol style="list-style-type: none"> 1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson Education, Second Edition. 2. Kevin Skahill, “VHDL for Programmable Logic”, PHI/Pearson education, 2006. 	
Reference Books: <ol style="list-style-type: none"> 1. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science+Business Media, LLC, Fifth edition. 2. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL” Pearson (Prentice Hall), Second edition. 3. Padmanabhan, Tripura Sundari, “Design through Verilog HDL”, Wiley, 2016 or earlier. 	

INFORMATION THEORY AND CODING
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to:

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithms.
- Model discrete & continuous communication channels.
- Study various error control coding algorithms.

Modules

Module-1	RBT Level
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources (Section 4.1, 4.2 of Text 1).	L1, L2, L3
Module-2	
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2). Encoding of the Source Output, Shannon's Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1). Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm (Sections 3.6, 3.7, 3.8, 3.10 of Text 3).	L1, L2, L3
Module-3	
Information Channels: Communication Channels (Section 4.4 of Text 1). Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections 4.2, 4.3, 4.4, 4.6, 4.7 of Text 3).	L1, L2, L3
Module-4	

<p>Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.</p> <p>Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1).</p>	L1, L2, L3
Module-5	
<p>Some Important Cyclic Codes: Golay Codes, BCH Codes(Section 8.4 - Article 5 of Text 2).</p> <p>Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5 - Articles 1,2 and 3, 8.6- Article 1 of Text 2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course the students will be able to:</p> <ul style="list-style-type: none"> • Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source • Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms • Model the continuous and discrete communication channels using input, output and joint probabilities • Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes • Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996. 2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008. 3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007 2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering 	

3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

OPERATING SYSTEM
B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC553	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the services provided by an operating system. • Understand how processes are synchronized and scheduled. • Understand different approaches of memory management and virtual memory management. • Understand the structure and organization of the file system • Understand interprocess communication and deadlock situations. 			
Module-1			RBT Level
<p>Introduction to Operating Systems OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).</p>			L1, L2
Module-2			
<p>Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, 4.2, 4.3, 4.4.1 of Text).</p>			L1, L2
Module-3			
<p>Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies (Topics from Sections 5.5 to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1 of Text).</p>			L1, L2
Module-4			
<p>File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from Sections 7.1 to 7.8 of Text).</p>			L1, L2, L3
Module-5			
<p>Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Resource state modelling, Deadlock detection algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to</p>			L1, L2, L3

11.5 of Text).

Course outcomes: After studying this course, students will be able to:

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Book:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition, 2001.
2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

DSP Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL57	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory=03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using MATLAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).
6. (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
(ii) DFT computation of square pulse and Sinc function etc.
7. Design and implementation of FIR filter to meet given specifications (using different window techniques).
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

9. Linear convolution of two sequences
10. Circular convolution of two sequences
11. N-point DFT of a given sequence
12. Impulse response of first order and second order system
13. Implementation of FIR filter

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.

- Modelling of discrete time signals and systems and verification of its properties and results.
- Implementation of discrete computations using DSP processor and verify the results.
- Realize the digital filters using a simulation tool and a DSP processor and verify the frequency and phase response.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

HDL Lab
B.E., V Semester, EC/TC

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL58	IA Marks	20
Number of Lecture Hours/Week	01 Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

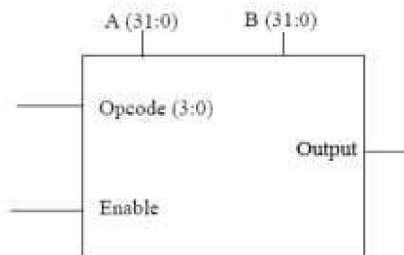
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesise the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

Part-A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer.
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
3. Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Write a Verilog code to model 32 bit ALU using the schematic diagram shown below



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.

- ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU Operation
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

5. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
6. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters, using Verilog code.

Part-B: INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
3. Write HDL code to control speed, direction of DC and Stepper motor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.
6. Write HDL code to simulate Elevator operation.

Course Outcomes: At the end of this course, students should be able to:

- Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

Object Oriented Programming Using C++

B.E. V Semester (Open Elective)

[As per Choice Based Credit System (CBCS)scheme]

Subject Code	15EC562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs/ Module	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Define Encapsulation, Inheritance and Polymorphism. • Solve the problem with object oriented approach. • Analyze the problem statement and build object oriented system model. • Describe the characters and behavior of the objects that comprise a system. • Explain function overloading, operator overloading and virtual functions. • Discuss the advantages of object oriented programming over procedure oriented programming. 			
Module -1			RBT Level
<p>Beginning with C++ and its features: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from Ch -2,3 of Text).</p>			L1, L2
Module -2			
<p>Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions (Selected Topics from Chap-4,5 of Text).</p>			L1, L2, L3
Module -3			
<p>Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text).</p>			L1, L2, L3
Module -4			
<p>Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).</p>			L1, L2, L3

Module -5	
Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text).	L1, L2, L3
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • Explain the basics of Object Oriented Programming concepts. • Apply the object initialization and destroy concept using constructors and destructors. • Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators. • Use the concept of inheritance to reduce the length of code and evaluate the usefulness. • Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs. • Use I/O operations and file streams in programs. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.</p> <p>Reference Book: Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.</p>	

B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours/Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

Module-1	RBT Level
<p>Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p>Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2)</p>	L1, L2, L3
Module-2	
<p>Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4).</p>	L1, L2, L3
Module-3	
<p>Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM (Relevant topics in Text 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK</p>	

<p>generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12, 7.13).</p>	
Module-4	
<p>Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI-The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol-by-Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2).</p> <p>Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).</p>	L1, L2, L3
Module-5	
<p>Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Associate and apply the concepts of Bandpass sampling to well specified signals and channels. • Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. • Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. • Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module • The students will have to answer 5 full questions, selecting one full question from each module 	
<p>Text Books:</p>	

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books:

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.

ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering**
[As per Choice Based Credit System (CBCS) scheme]

<u>ARM MICROCONTROLLER & EMBEDDED SYSTEMS</u>			
B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none">• Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.• Program ARM Cortex M3 using the various instructions and C language for different applications.• Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.• Develop the hardware software co-design and firmware design approaches.• Explain the need of real time operating system for embedded system applications.			
Module-1			
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) L1, L2			
Module-2			
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) L1, L2, L3			
Module-3			
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. (Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). L1, L2, L3			
Module-4			
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded			

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).

(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues - Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment - Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques

(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

L1, L2, L3

Course outcomes: After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.

VLSI Design
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS - 04

Course Objectives: The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

Module-1	RBT Level
<p>Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).</p> <p>Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).</p>	L1, L2
Module-2	
<p>MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.</p> <p>Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).</p>	L1, L2, L3
Module-3	
<p>Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters</p> <p>Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).</p>	L1, L2, L3
Module-4	
<p>Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).</p> <p>FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture, Physical design for FPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3).</p>	L1, L2, L3
Module-5	
<p>Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).</p>	L1, L2, L3

Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).

Course outcomes: At the end of the course, the students will be able to:

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Interpret Memory elements along with timing considerations
- Demonstrate knowledge of FPGA based system design
- Interpret testing and testability issues in VLSI Design
- Analyze CMOS subsystems and architectural issues with the design constraints.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. **“Basic VLSI Design”**- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994).
2. **“CMOS VLSI Design- A Circuits and Systems Perspective”**- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3. **“FPGA Based System Design”**- Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

COMPUTER COMMUNICATION NETWORKS
B.E., VI Semester, Electronics & Communication Engineering /
Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

COMPUTER COMMUNICATION NETWORKS			
B.E., VI Semester, Electronics & Communication Engineering /			
Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the layering architecture of OSI reference model and TCP/IP protocol suite. • Understand the protocols associated with each layer. • Learn the different networking architectures and their representations. • Learn the various routing techniques and the transport layer services. 			
Module-1			
Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet.			
Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.			
Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. L1, L2			
Module-2			
Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing.			
Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. L1, L2			
Module-3			
Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers.			
Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages.			
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing,			

DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. **L1, L2**

Module-4

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging Tools, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. **L1, L2, L3**

Module-5

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. **L1, L2**

Course Outcomes: At the end of the course, the students will be able to:

- Identify the protocols and services of Data link layer.
- Identify the protocols and functions associated with the transport layer services.
- Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
- Distinguish the basic network configurations and standards associated with each network.
- Construct a network model and determine the routing of packets using different routing algorithms.

Text Book:

Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016
ISBN: 1-25-906475-3

Reference Books:

1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4
2. Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282

ARTIFICIAL NEURAL NETWORKS
B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC653	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: The objectives of this course are:</p> <ul style="list-style-type: none"> • Understand the basics of ANN and comparison with Human brain • Provide knowledge on Generalization and function approximation and various architectures of building an ANN • Provide knowledge of reinforcement learning using neural networks • Provide knowledge of unsupervised learning using neural networks. 			
Module-1			RBT Level
<p>Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.</p>			L1, L2
Module-2			
<p>Supervised Learning: Perceptron learning and Non Separable sets, -Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm.</p>			L1, L2, L3
Module-3			
<p>Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.</p>			L1, L2, L3
Module-4			
<p>Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.</p>			L1, L2, L3
Module-5			
<p>Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.</p>			L1, L2, L3

Course outcomes: At the end of the course, students should be able to:

- Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
- Understand the concepts and techniques of neural networks through the study of the most important neural network models.
- Evaluate whether neural networks are appropriate to a particular application.
- Apply neural networks to particular applications, and to know what steps to take to improve performance.

Question paper pattern:

The question paper will have ten questions.

- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. **Introduction to Artificial Neural Systems**-J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks**-B. Yegnanarayana, PHI, New Delhi 1998.

**6th Semester Open Electives Syllabus for the courses offered by
EC/TC Board:**

DATA STRUCTURE USING C++ B.E VI Semester (Open Elective) [As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC661	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs per Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamentals of data structures and their applications essential for programming/problem solving • Analyze Linear Data Structures: Stack, Queues, Lists • Analyze Non Linear Data Structures: Trees • Assess appropriate data structure during program development/Problem Solving 			
Module -1			
INTRODUCTION: Functions and parameters, Dynamic memory allocation, Recursion. LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. L1, L2			
Module -2			
ARRAYS AND MATRICES: Arrays, Matrices, Special matrices, Sparse matrices. STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Paranthesis Matching & Towers of Hanoi. L1, L2, L3			
Module -3			
QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement. HASHING: Dictionaries, Linear representation, Hash table representation. L1, L2, L3			
Module -4			
BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. L1, L2, L3			
Module -5			
Priority Queues: Linear lists, Heaps, Applications-Heap Sorting. Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates. L1, L2, L3			

Course outcomes: After studying this course, students will be able to:

- Acquire knowledge of Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
- Understand non Linear data structures trees and their applications
- Design appropriate data structures for solving computing problems
- Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++**, Sartaj Sahni, Mc. Graw Hill, 2000.
2. **Object Oriented Programming with C++**, E.Balaguruswamy, TMH, 6th Edition, 2013.
3. **Programming in C++**, E.Balaguruswamy. TMH, 4th, 2010.

EMBEDDED CONTROLLER LAB

B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL67	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

Course outcomes: After studying this course, students will be able to:

- Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Conduction of Practical Examination:

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

COMPUTER NETWORKS LABORATORY
B.E., VI Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL68	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS - 02			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Choose suitable tools to model a network and understand the protocols at various OSI reference levels. • Design a suitable network and simulate using a Network simulator tool. • Simulate the networking concepts and protocols using C/C++ programming. • Model the networks for different configurations and analyze the results. 			
Laboratory Experiments			
PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool			

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
6. Implementation of Link state routing algorithm.

PART-B: Implement the following in C/C++

1. Write a program for a HDLC frame to perform the following.
 - i) Bit stuffing
 - ii) Character stuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.

3. Implement Dijkstra's algorithm to compute the shortest routing path.
4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
 - a. Without error
 - b. With error
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol
6. Write a program for congestion control using leaky bucket algorithm.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Use the network simulator for learning and practice of networking algorithms.
- Illustrate the operations of network protocols and algorithms using C programming.
- Simulate the network with different configurations to measure the performance parameters.
- Implement the data link and routing protocols using C programming.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination one question from software and one question from hardware or only one hardware experiments based on the complexity to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C SEVENTH SEMESTER SYLLABUS

MICROWAVES AND ANTENNAS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	15EC71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none">• Describe the microwave properties and its transmission media• Describe microwave devices for several applications• Understand the basics of antenna theory• Select antennas for specific applications			
Module-1			
Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2) Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) L1, L2			
Module-2			
Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3) Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) L1, L2			
Module-3			
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15) L1, L2, L3			

Module-4

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (Text 3: 5.1 – 5.10, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of $\lambda/2$ Antenna. (Text 3: 6.1 – 6.6)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas. (Text 3: 7.1-7.8, 7.19, 7.20)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits**- Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4th Special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.

DIGITAL IMAGE PROCESSING

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC72	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: The objectives of this course are to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of digital image processing • Understand the image transform used in digital image processing • Understand the image enhancement techniques used in digital image processing • Understand the image restoration techniques and methods used in digital image processing • Understand the Morphological Operations and Segmentation used in digital image processing 			
Module-1			RBT Level
<p>Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. [Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]</p>			L1, L2
Module-2			
<p>Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. [Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10]</p>			L1, L2, L3
Module-3			
<p>Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. [Text: Chapter 5: Sections 5.2, to 5.9]</p>			L1, L2, L3
Module-4			

<p>Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. [Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5]</p>	L1, L2, L3
Module-5	
<p>Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds. Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2]</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course students should be able to:</p> <ul style="list-style-type: none"> • Understand image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of Image Enhancement techniques. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 16 marks. • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004. 	

POWER ELECTRONICS

B.E., VII Semester, Electronics & Communication Engineering

[As per Choice Based Credit System (CBCS) scheme]

<u>POWER ELECTRONICS</u>			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15EC73	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none">• Understand the construction and working of various power devices.• Study and analysis of thyristor circuits with different triggering conditions.• Learn the applications of power devices in controlled rectifiers, converters and inverters.• Study of power electronics circuits under various load conditions.			
Module-1			
Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations. (Text 1) L1, L2			
Module-2			
Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation - Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) L1, L2, L3			
Module-3			
Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase controllers with resistive and inductive loads. (Text 1) L1, L2, L3			
Module-4			
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design. (Text 1) L1, L2			
Module-5			
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design. Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state			

relays, Microelectronic relays. (Text 1) **L1, L2**

Course Outcomes: At the end of the course students should be able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 05 marks out of 20 Internal Assessment (IA) Marks, reserved for the other activities.

Text Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

MULTIMEDIA COMMUNICATION

**B.E., VII Semester, Electronics & Communication Engineering/
Telecommunication Engineering**

[As per Choice Based credit System (CBCS) Scheme

Subject Code	15EC741	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours / Module)	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to:

- Gain fundamental knowledge in understanding the basics of different multimedia networks and applications.
- Understand digitization principle techniques required to analyze different media types.
- Analyze compression techniques required to compress text and image and gain knowledge of DMS.
- Analyze compression techniques required to compress audio and video.
- Gain fundamental knowledge about multimedia communication across different networks.

REAL TIME SYSTEMS

B.E., VII Semester, Electronics & Communication Engineering /Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC743	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
Credits – 03			
<p>Course Objectives: This Course will enable students to:</p> <ul style="list-style-type: none"> • Discuss the historical background of Real-time systems and its classifications. • Describe the concepts of computer control and hardware components for Real-Time Application. • Discuss the languages to develop software for Real-Time Applications. • Explain the concepts of operating system and RTS development methodologies. 			
Modules			RBT Level
Module-1			
<p>Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.</p> <p>Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6)</p>			L1, L2
Module-2			
<p>Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8)</p>			L1, L2
Module-3			
<p>Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. (Text Book: 5.1 to 5.14)</p>			L1, L2, L3
Module-4			
<p>Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11)</p>			L1, L2

Module-5	
<p>Design of RTS - General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.</p> <p>RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hatley and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5)</p>	L1, L2, L3
<p>Course Outcomes: At the end of the course, students should be able to:</p> <ul style="list-style-type: none"> • Understand the fundamentals of Real time systems and its classifications. • Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications. • Develop the software languages to meet Real time applications. • Apply suitable methodologies to design and develop Real-Time Systems. 	
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. C.M. Krishna, Kang G. Shin, "Real -Time Systems", McGraw -Hill International Editions, 1997. 2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005. 3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005. 	

DSP Algorithms and Architecture
B.E., VII Semester, Electronics & Communication Engineering
/Telecommunication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC751	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Figure out the knowledge and concepts of digital signal processing techniques. • Understand the computational building blocks of DSP processors and its speed issues. • Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor. • Learn how to interface the external devices to TMS320C54xx processor in various modes. • Understand basic DSP algorithms with their implementation. 			
Module-1			RBT Level
<p>Introduction to Digital Signal Processing: Introduction, A Digital Signal - Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.</p> <p>Computational Accuracy in DSP Implementations: Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation.</p>			L1, L2
Module-2			
<p>Architectures for Programmable Digital Signal - Processing Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.</p>			L1, L2, L3
Module-3			
<p>Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54XX, Memory Space of TMS320C54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On - Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.</p>			L1, L2, L3
Module-4			

<p>Implementation of Basic DSP Algorithms: Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).</p> <p>Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS320C54xx.</p>	L1, L2, L3
Module-5	
<p>Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).</p> <p>Interfacing and Applications of DSP Processors: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.</p>	L1, L2, L3
<p>Course Outcomes: At the end of this course, students would be able to</p> <ul style="list-style-type: none"> • Comprehend the knowledge and concepts of digital signal processing techniques. • Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor. • Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor. • Develop basic DSP algorithms using DSP processors. • Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device. • Demonstrate the programming of CODEC interfacing. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of Three sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: “Digital Signal Processing”, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. “Digital Signal Processing: A practical approach”, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002. 2. “Digital Signal Processors”, B Venkataramani and M Bhaskar, TMH, 2nd, 2010 3. “Architectures for Digital Signal Processing”, Peter Pirsch John Wiley, 2008 	

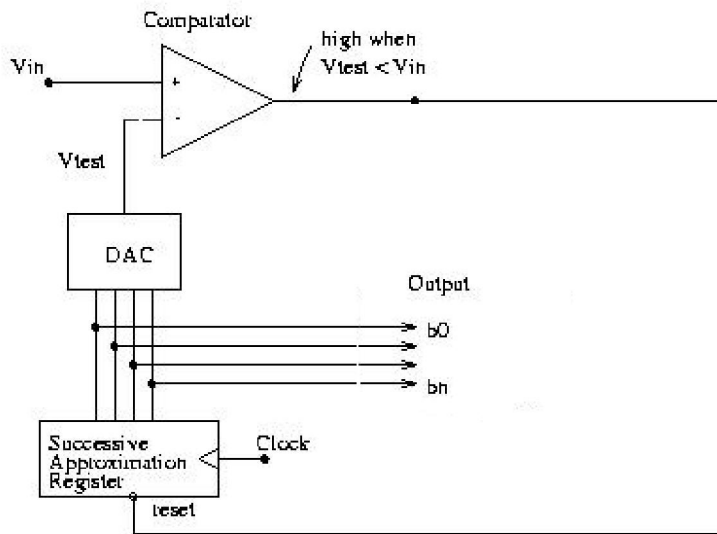
VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS) scheme]

Subject Code	15ECL77	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	Exam Marks	80
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS - 02			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explore the CAD tool and understand the flow of the Full Custom IC design cycle. • Learn DRC, LVS and Parasitic Extraction of the various designs. • Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts. • Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts. 			
<p>Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind</p>			
Laboratory Experiments			
PART - A			
ASIC-DIGITAL DESIGN			
<p>1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.</p> <ol style="list-style-type: none"> i. An inverter ii. A Buffer iii. Transmission Gate iv. Basic/universal gates v. Flip flop -RS, D, JK, MS, T vi. Serial & Parallel adder vii. 4-bit counter [Synchronous and Asynchronous counter] viii. Successive approximation register [SAR] 			

PART - B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.
[Specifications to GDS-II]



* An appropriate constraint should be given.

** Appropriate specification should be given.

*** Applicable Library should be added & information should be given to the Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C EIGHTH SEMESTER SYLLABUS

Wireless Cellular and LTE 4G Broadband

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC81	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number	50 (10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the basics of LTE standardization phases and specifications. • Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles. • Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. • Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth. 			
Module - 1			RBT Level
<p>Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).</p> <p>Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC - Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 - 2.7 of Text).</p>			L1, L2
Module - 2			
<p>Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 - 3.6 of Text).</p> <p>OFDMA and SC-FDMA: OFDM with FDMA, TDMA, CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 - 4.3, 4.5 of Text).</p> <p>Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 - 5.6 of Text).</p>			L1, L2
Module - 3			
<p>Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink</p>			L1, L2

SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).	
Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text).	
Module – 4	
Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).	L1, L2
Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text).	
Module – 5	
Radio Resource Management and Mobility Management: PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination(Sec 10.1 – 10.5 of Text).	L1, L2
Course Outcomes: At the end of the course, students will be able to:	
<ul style="list-style-type: none"> • Understand the system architecture and the functional standard specified in LTE 4G. • Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. • Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. • Test and Evaluate the Performance of resource management and packet data processing and transport algorithms. 	
Question Paper pattern:	
<ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
Text Book:	
Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.	

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
3. 'LTE - The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

FIBER OPTICS and NETWORKS
B.E., VIII Semester, Electronics & Communication Engineering
 [As per Choice Based Credit System (CBCS)]

Subject Code	15EC82	IA Marks	20
Number of Lecture Hours/Week	4	Exam Marks	80
Total Number of Lecture Hours	50(10 Hours / Module)	Exam Hours	03
CREDITS - 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn the basic principle of optical fiber communication with different modes of light propagation. • Understand the transmission characteristics and losses in optical fiber. • Study of optical components and its applications in optical communication networks. • Learn the network standards in optical fiber and understand the network architectures along with its functionalities. 			
Module -1			RBT Level
<p>Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2)</p>			L1, L2
Module -2			
<p>Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p>Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2)</p>			L1, L2
Module -3			
<p>Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.</p> <p>Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.</p> <p>Optical Receiver: Optical Receiver Operation: Error sources,</p>			L1, L2

Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1)	
Module -4	
<p>WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,</p> <p>Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1)</p>	L1, L2
Module -5	
<p>Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropolitan area networks, Access networks, Local area networks. (Text 2)</p>	L1, L2
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Classification and working of optical fiber with different modes of signal propagation. 2. Describe the transmission characteristics and losses in optical fiber communication. 3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers. 4. Describe the constructional features and the characteristics of optical sources and detectors. 5. Illustrate the networking aspects of optical fiber and describe various standards associated with it. 	
<p>Question Paper pattern:</p> <ul style="list-style-type: none"> • The Question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full Questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The Students will have to answer 5 full Questions, selecting one full Question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gerd Keiser , Optical Fiber Communication, 5th Edition, McGraw Hill 	

Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd
Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Book:

Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005,
ISBN:0130085103

Radar Engineering			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	15EC833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the Radar fundamentals and analyze the radar signals. • Understand various technologies involved in the design of radar transmitters and receivers. • Learn various radars like MTI, Doppler and tracking radars and their comparison 			
Modules			RBT Level
Module-1			
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power.			L1, L2, L3
Simple form of the Radar Equation , Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text)			
Module-2			
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection,			L1, L2, L3
Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)			
Module-3			
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler,			L1, L2, L3
Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)			
Module-4			
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse.			L1, L2, L3
Sequential Lobing , Conical Scan Tracking, Block Diagram of Conical Scan			

Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text)	
Module-5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (Chapter 9: 9.1, 9.2 9.4, 9.5 of Text) Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)	L1, L2, L3
Course outcomes: At the end of the course, students will be able to: <ul style="list-style-type: none"> • Understand the radar fundamentals and radar signals. • Explain the working principle of pulse Doppler radars, their applications and limitations • Describe the working of various radar transmitters and receivers. • Analyze the range parameters of pulse radar system which affect the system performance 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.	
Reference Books: <ol style="list-style-type: none"> 1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004. 2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998. 3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. Holm. Yesdee, 2013 	

B.E: Electronics & Communication Engineering

Program Outcomes (POs)

At the end of the B.E program, students are expected to have developed the following outcomes.

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B.E Electronics & Communication Engineering program, students are expected to have developed the following program specific outcomes.

PSO1: Specify, design, build and test analog, digital and embedded systems for signal processing

PSO2: Understand and architect wired and wireless analog and digital communication systems as per specifications, and determine their performance.

Note

1. The Course Outcomes and RBT levels indicated for each course in the syllabus are indicative/suggestive. The faculty can set them appropriately according to their lesson plan.
2. The Question Paper format for the theory courses is as follows:

Question Paper Pattern for Theory Courses (2017 Scheme):

- The question paper will have TEN questions.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of Four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

SCHEME OF TEACHING AND EXAMINATION
B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)

III SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics –III*	Maths	04		03	60	40	100	4
2	17EC32	Electronic Instrumentation	EC	03		03	60	40	100	3
3	17EC33	Analog Electronics	EC	04		03	60	40	100	4
4	17EC34	Digital Electronics	EC	04		03	60	40	100	4
5	17EC35	Network Analysis	EC	04		03	60	40	100	4
6	17EC36	Engineering Electromagnetics	EC	04		03	60	40	100	4
7	17ECL37	Analog Electronics Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECL38	Digital Electronics Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1.Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

**B.E Electronics & Communication Engineering / Telecommunication Engineering
(Common to Electronics & Communication and Telecommunication Engineering)**

IV SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics –IV*	Maths	04		03	60	40	100	4
2	17EC42	Signals and Systems	EC	04		03	60	40	100	4
3	17EC43	Control Systems	EC	04		03	60	40	100	4
4	17EC44	Principles of Communication Systems	EC	04		03	60	40	100	4
5	17EC45	Linear Integrated Circuits	EC	04		03	60	40	100	4
6	17EC46	Microprocessor	EC	03		03	60	40	100	3
7	17ECL47	Microprocessor Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECL48	Linear ICs and Communication Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

1	17MATDIP41	Additional Mathematics –II	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

B.E.: Electronics & Communication Engineering

V SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17ES51	Management and Entrepreneurship Development	EC	04		03	60	40	100	4
2	17EC52	Digital Signal Processing	EC	04		03	60	40	100	4
3	17EC53	Verilog HDL	EC	04		03	60	40	100	4
4	17EC54	Information Theory & Coding	EC	04		03	60	40	100	4
5	17EC55X	Professional Elective-1	EC	03		03	60	40	100	3
6	17EC56X	Open Elective-1	EC	03		03	60	40	100	3
7	17ECL57	DSP Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECL58	HDL Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory: 22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-1		Open Elective-1	
17EC553	Operating System	17EC562	Object Oriented Programming in C++

B.E.: Electronics & Communication Engineering

VI SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EC61	Digital Communication	EC	04		03	60	40	100	4
2	17EC62	ARM Microcontroller & Embedded Systems	EC	04		03	60	40	100	4
3	17EC63	VLSI Design	EC	04		03	60	40	100	4
4	17EC64	Computer Communication Networks	EC	04		03	60	40	100	4
5	17EC65X	Professional Elective-2	EC	03		03	60	40	100	3
6	17EC66X	Open Elective-2	EC	03		03	60	40	100	3
7	17ECL67	Embedded Controller Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECL68	Computer Networks Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
TOTAL				Theory: 22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-2		Open Elective-2	
17EC653	Artificial Neural Network	17EC661	Data Structures in C++

B.E.: Electronics & Communication Engineering

VII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks		Total Marks
1	17EC71	Microwave and Antennas	EC	04		03	60	40	100	4
2	17EC72	Digital Image Processing	EC	04		03	60	40	100	4
3	17EC73	Power Electronics	EC	04		03	60	40	100	4
4	17EC74X	Professional Elective-3	EC	03		03	60	40	100	3
5	17EC75X	Professional Elective-4	EC	03		03	60	40	100	3
6	17ECL76	Advanced Communication Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17ECL77	VLSI Lab	EC	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17ECP78	Project Work Phase-I + Project work Seminar	EC		03		-	100	100	2
TOTAL				Theory: 18 hours Practical and Project: 09 hours		21	420	380	800	24

Professional Elective-3		Professional Elective-4	
17EC743	Real Time System	17EC751	DSP algorithms & Architecture

B.E.: Electronics & Communication Engineering

VIII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EC81	Wireless Cellular and LTE 4G Broadband	EC	4	-	3	60	40	100	4
2	17EC82	Fiber Optics & Networks	EC	4	-	3	60	40	100	4
3	17EC83X	Professional Elective-5	EC	3	-	3	60	40	100	3
4	17EC84	Internship/Professional Practice	EC	Industry Oriented		3	50	50	100	2
5	17ECP85	Project Work	EC	-	6	3	100	100	200	6
6	17ECS86	Seminar	EC	-	4	-	-	100	100	1
TOTAL				Theory: 11 hours Project and Seminar: 10 hours		15	330	370	700	20

Professional Elective-5	
17EC833	RADAR Engg.

**B.E., III Semester, Electronics & Communication Engineering
/Telecommunication Engineering**

ENGINEERING MATHEMATICS-III			
B.E., III Semester, Common to all Branches			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17MAT31	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Introduce most commonly used analytical and numerical methods in the different engineering fields. • Learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods. • Solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Module-1			
<p>Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field. L1, L2, L4</p>			
Module-2			
<p>Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform.</p> <p>Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations. L2, L3, L4</p>			
Module-3			
<p>Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis-lines of regression (without proof) –Problems</p> <p>Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$.</p> <p>Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. L3</p>			
Module-4			
<p>Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems</p> <p>Numerical integration: Simpson's $(1/3)^{\text{th}}$ and $(3/8)^{\text{th}}$ rules, Weddle's rule (without proof) – Problems. L3</p>			

Module-5

Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. **L3, L4**

Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, Problems. **L2, L4**

Course outcomes: On completion of this course, students are able to:

- Know the use of periodic signals and Fourier series to analyze circuits and system communications.
- Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.
- Employ appropriate numerical methods to solve algebraic and transcendental equations.
- Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.
- Determine the extremals of functionals and solve the simple problems of the calculus of variations.

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.

Reference Books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

Web Link and Video Lectures:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. <http://www.khanacademy.org/>
3. <http://www.class-central.com/subject/math>

ADDITIONAL MATHEMATICS - I
B.E., III Semester, Common to all Branches
(A Bridge course for Lateral Entry students of III Sem. B. E.)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17MATDIP31	CIE Marks	--
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

Credits – 00

Course Objectives: This course will enable students to:

- Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation.
- Solve first order differential equations.

Module-1

Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).

Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems.

L1

Module-2

Differential Calculus: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Leibnitz's theorem (without proof). Polar curves-angle between the radius vector and the tangent pedal equation- Problems. Maclaurin's series expansions- Illustrative examples. Partial Differentiation : Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. Application to Jacobians.

L1, L2

Module-3

Integral Calculus: Statement of reduction formulae for $\sin^n x$, $\cos^n x$, and $\sin^m x \cos^n x$ and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.

L1, L2

Module-4

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). Solenoidal and irrotational vector fields-Problems.

L1, L2

Module-5

Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types.

L1, L2

Course outcomes: On completion of the course, students are able to:

- Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in related area.

- Use derivatives and partial derivatives to calculate rates of change of multivariate functions.
- Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region.
- Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions.
- Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

Text Book:

B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

ELECTRONIC INSTRUMENTATION**SEMESTER – III (EC/TC)****[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC32	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

CREDITS – 03**Course objectives:** This course will enable students to:

- Define and describe accuracy and precision, types of errors.
- Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters.
- Describe functional concepts and operation of various Analog and Digital measuring instruments.
- Describe basic concepts and operation of Digital Voltmeters.
- Describe and discuss functioning and types of Oscilloscopes, Signal generators, AC and DC bridges.
- Recognize and describe significance and working of different types of transducers.

Module- 1**Measurement and Error:** Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **(Text 2)****Ammeters:** DC Ammeter, Multirange Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **(Text 1)****Voltmeters and Multimeters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multirange Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multimeter. **(Text 1) L1, L2, L3****Module -2****Digital Voltmeters:** Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, $3\frac{1}{2}$ -Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, **(Text 1)****Digital Instruments:** Introduction, Digital Multimeters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, **(Text 1) L1, L2,L3****Module -3**

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. **(Text 1)**

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, **(Text 1) L1, L2**

Module -4

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger. **(Text 1)**

Bridges: Introduction, Wheatstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge. **(Text 1) L1, L2, L3**

Module -5

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, - LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor. **(Text 1) L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Describe instrument measurement errors and calculate them.
- Describe the operation of Ammeters, Voltmeters, Multimeters and develop circuits for multirange Ammeters and Voltmeters.
- Describe functional concepts and operation of Digital voltmeters and instruments to measure voltage, frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions.
- Describe functional concepts and operation of various Analog measuring instruments to measure field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance.
- Describe and discuss functioning and types of Oscilloscopes, Signal generators and Transducers.
- Utilize AC and DC bridges for passive component and frequency measurements.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.

Reference Books:

1. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN:9789332556065.
2. A. K. Sawhney, "Electronics and Electrical Measurements", Dhanpat Rai & Sons. ISBN -81-7700-016-0

ANALOG ELECTRONICS
SEMESTER – III (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC33	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Explain various BJT parameters, connections and configurations.
- Explain BJT Amplifier, Hybrid Equivalent and Hybrid Models.
- Explain construction and characteristics of JFETs and MOSFETs.
- Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- Construct frequency response of BJT and FET amplifiers at various frequencies.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

Module -1

BJT AC Analysis: BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid π Model.
L1, L2,L3

Module -2

Field Effect Transistors: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.
FET Amplifiers: JFET small signal model, Fixed bias configuration, Self bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.
L1, L2, L3

Module -3

BJT and JFET Frequency Response: Logarithms, Decibels, Low frequency response – BJT Amplifier with RL, Low frequency response-FET Amplifier, Miller effect capacitance, High frequency response – BJT Amplifier, High frequency response-FET Amplifier, Multistage Frequency Effects.
L1, L2, L3

Module -4

Feedback and Oscillator Circuits: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wien bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator.
L1,L2, L3

Module -5

Power Amplifiers: Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers.

Voltage Regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators.

L1, L2, L3

Course Outcomes: After studying this course, students will be able to:

- Describe the working principle and characteristics of BJT, FET, Single stage, cascaded and feedback amplifiers.
- Describe the Phase shift, Wien bridge, tuned and crystal oscillators using BJT/FET/UJT.
- Calculate the AC gain and impedance for BJT using r_e and h parameters models for CE and CC configuration.
- Determine the performance characteristics and parameters of BJT and FET amplifier using small signal model.
- Determine the parameters which affect the low frequency and high frequency responses of BJT and FET amplifiers and draw the characteristics.
- Evaluate the efficiency of Class A and Class B power amplifiers and voltage regulators.

Text Book:

Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th/11th Edition, 2012, ISBN:978-81-317-6459-6.

Reference Books:

1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Application", 5th Edition ISBN:0198062257
2. Fundamentals of Microelectronics, Behzad Razavi, John Wiley ISBN 2013 978-81-265-2307-8
3. J.Millman & C.C.Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5
4. K. A. Navas, "Electronics Lab Manual", Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424.

DIGITAL ELECTRONICS
SEMESTER – III (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC34	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McClusky Techniques.
- Design combinational logic circuits.
- Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators.
- Describe Latches and Flip-flops, Registers and Counters.
- Analyze Mealy and Moore Models.
- Develop state diagrams Synchronous Sequential Circuits.

Module – 1

Principles of combination logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables (Text 1, Chapter 3). **L1, L2, L3**

Module -2

Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators (Text 1, Chapter 4). **L1, L2, L3**

Module -3

Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations. (Text 2, Chapter 6) **L1, L2**

Module -4

Simple Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counters, Design of a synchronous mod-n counter using clocked T , JK , D and SR flip-flops. (Text 2, Chapter 6) **L1,L2, L3**

Module -5

Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design. (Text 1, Chapter 6) **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Develop simplified switching equation using Karnaugh Maps and Quine-McClusky techniques.
- Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators.
- Explain the working of Latches and Flip Flops (SR,D,T and JK).
- Design Synchronous/Asynchronous Counters and Shift registers using Flip Flops.
- Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
- Apply the knowledge gained in the design of Counters and Registers.

Text Books:

1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1.
2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002. ISBN 978-0-07-052906-9.

Reference Books:

1. D. P. Kothari and J. S Dhillon, “Digital Circuits and Design”, Pearson, 2016, ISBN:9789332543539.
2. Morris Mano, “Digital Design”, Prentice Hall of India, Third Edition.
3. Charles H Roth, Jr., “Fundamentals of logic design”, Cengage Learning.
4. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN: 9788120351424.

NETWORK ANALYSIS
SEMESTER – III (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC35	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course enables students to:

- Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.
- Explain network Thevenin's, Millman's, Superposition, Reciprocity, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits.
- Explain the behavior of networks subjected to transient conditions.
- Use applications of Laplace transforms to network problems.
- Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response.
- Study two port network parameters like Z, Y, T and h and their inter-relationships and applications.

Module -1

Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. **L1, L2,L3,L4**

Module -2

Network Theorems:

Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem. **L1, L2, L3,L4**

Module -3

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis. **L1, L2, L3,L4**

Module -4

Resonant Circuits: Series and parallel resonance, frequency- response of series and Parallel circuits, Q-Factor, Bandwidth. **L1, L2, L3,L4**

Module -5

Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets. **L1, L2, L3,L4**

Course Outcomes: After studying this course, students will be able to:

- Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/ source transformation/ source shifting.
- Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions.
- Calculate current and voltages for the given circuit under transient conditions.
- Apply Laplace transform to solve the given network.
- Evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits
- Solve the given network using specified two port network parameter like Z or Y or T or h.

Text Books:

1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958.
2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677.

Reference Books:

1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", TMH 7th Edition, 2010.
2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8thed, 2006.
3. Charles K Alexander and Mathew N O Sadiku, " Fundamentals of Electric Circuits", Tata McGraw-Hill, 3rd Ed, 2009.

ENGINEERING ELECTROMAGNETICS**SEMESTER – III (EC/TC)****[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC36	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04**Course objectives:** This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behaviour in different media
- Acquire knowledge of Poynting theorem and its application of power flow.

Module - 1**Coulomb's Law, Electric Field Intensity and Flux density**Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density. **L1, L2, L3****Module -2****Gauss's law and Divergence**Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ∇ and divergence theorem.**Energy, Potential and Conductors**Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Current and Current density, Continuity of current. **L1, L2, L3****Module -3****Poisson's and Laplace's Equations**

Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation.

Steady Magnetic FieldBiot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. **L1, L2, L3****Module -4**

Magnetic Forces

Force on a moving charge, differential current elements, Force between differential current elements.

Magnetic Materials

Magnetisation and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials. **L1, L2, L3**

Module -5**Time-varying fields and Maxwell's equations**

Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.

Uniform Plane Wave

Wave propagation in free space and good conductors. Poynting's theorem and wave power, Skin Effect. **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
- Determine potential and energy with respect to point charge and capacitance using Laplace equation.
- Calculate magnetic field, force, and potential energy with respect to magnetic materials.
- Apply Maxwell's equation for time varying fields, EM waves in free space and conductors.
- Evaluate power associated with EM waves using Poynting theorem.

Text Book:

W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2009, ISBN-978-0-07-061223-5.

Reference Books:

1. John Krauss and Daniel A Fleisch, "Electromagnetics with applications", McGraw- Hill.
2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson.

ANALOG ELECTRONICS LABORATORY
SEMESTER – III (EC/TC)
[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	17ECL37	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	SEE Marks	60
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

- Rectifiers and Voltage Regulators.
- BJT characteristics and Amplifiers.
- JFET Characteristics and Amplifiers.
- MOSFET Characteristics and Amplifiers
- Power Amplifiers.
- RC-Phase shift, Hartley, Colpitts and Crystal Oscillators.

NOTE: The experiments are to be carried using discrete components only.

Laboratory Experiments:

1. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency:
 (a) Full Wave Rectifier (b) Bridge Rectifier
2. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
3. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.
4. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.
5. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.
6. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.
7. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
10. Design and set-up the RC-Phase shift Oscillator using FET, and calculate the frequency of output waveform.
11. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
12. Design and set-up the crystal oscillator and determine the frequency of oscillation.
<p>Course Outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> ● Test circuits of rectifiers, clipping circuits, clamping circuits and voltage regulators. ● Determine the characteristics of BJT and FET amplifiers and plot its frequency response. ● Compute the performance parameters of amplifiers and voltage regulators ● Design and test the basic BJT/FET amplifiers, BJT Power amplifier and oscillators.
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> ● All laboratory experiments are to be included for practical examination. ● Students are allowed to pick one experiment from the lot. ● Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. ● Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

DIGITAL ELECTRONICS LAB
SEMESTER – III (EC/TC)
[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	17ECL38	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	SEE Marks	60
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience in design, realisation and verification of

- Demorgan's Theorem, SOP, POS forms
- Full/Parallel Adders, Subtractors and Magnitude Comparator
- Demultiplexers and Decoders applications
- Flip-Flops, Shift registers and Counters

NOTE:

1. Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used.
2. For experiment No. 11 and 12 any open source or licensed simulation tool may be used.

Laboratory Experiments:

1. Verify
 - (a) Demorgan's Theorem for 2 variables.
 - (b) The sum-of product and product-of-sum expressions using universal gates.
2. Design and implement
 - (a) Full Adder using (i) basic logic gates and (ii) NAND gates.
 - (b) Full subtractor using (i) basic logic gates and (ii) NAND gates.
3. Design and implement 4-bit Parallel Adder/ Subtractor using IC 7483.
4. Design and Implementation of 5-bit Magnitude Comparator using IC 7485.
5. Realize
 - (a) Adder & Subtractor using IC 74153.
 - (b) 3-variable function using IC 74151(8:1MUX).
6. Realize a Boolean expression using decoder IC74139.
7. Realize Master-Slave JK, D & T Flip-Flops using NAND Gates.
8. Realize the following shift registers using IC7474/IC 7495
 - (a) SISO (b) SIPO (c) PISO (d) PIPO (e) Ring and (f) Johnson counter.
9. Realize
 - (i) Mod-N Asynchronous Counter using IC7490 and
 - (ii) Mod-N Synchronous counter using IC74192
10. Design Pseudo Random Sequence generator using 7495.

11. Simulate Full- Adder using simulation tool.

12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool.

Course Outcomes: On the completion of this laboratory course, the students will be able to:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers.
- Realize Boolean expression using decoders.
- Construct and test flips-flops, counters and shift registers.
- Simulate full adder and up/down counters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C FOURTH SEMESTER SYLLABUS

ENGINEERING MATHEMATICS-IV			
B.E., IV Semester, Common to all Branches			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	15MAT41	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. 			
Module-1			
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor’s series method, modified Euler’s method, Runge - Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). L1, L3			
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne’s method.			
Special Functions: Series solution-Frobenius method. Series solution of Bessel’s differential equation leading to $J_n(x)$ -Bessel’s function of first kind. Basic properties and orthogonality. Series solution of Legendre’s differential equation leading to $P_n(x)$ -Legendre polynomials. Rodrigue’s formula, problems. L3			
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem (without proof) and problems. L1, L3			
Transformations: Conformal transformations, discussion of transformations: $w=z^2$, $w=e^z$, $w=z + \frac{1}{z}$ ($z \neq 0$) and bilinear transformations-problems. L1			
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.			
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient. L3			

Module-5

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **L3**

Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. **L1**

Course Outcomes: On completion of this course, students are able to:

- Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods.
- Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory.
- Describe conformal and bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing.
- Solve problems of quantum mechanics, hydrodynamics and heat conduction by employing Bessel's function relating to cylindrical polar coordinate systems and Legendre's polynomials relating to spherical polar coordinate systems.
- Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering.
- Draw the validity of the hypothesis proposed for the given sampling distribution in accepting or rejecting the hypothesis.
- Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events.
- Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process.

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.

Reference Books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

Web Link and Video Lectures:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. <http://www.khanacademy.org/>
3. <http://www.class-central.com/subject/math>

ADDITIONAL MATHEMATICS - II
B.E., IV Semester, Common to all Branches
(A Bridge course for Lateral Entry students of IV Sem. B. E.)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	15MATDIP41	CIE Marks	--
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

Credits – 00

Course Objectives: This course will enable students to:

- Understand essential concepts of linear algebra.
- Solve second and higher order differential equations.
- Understand Laplace and inverse Laplace transforms and elementary probability theory.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples. **L1,L3**

Module-2

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. Solutions of initial value problems. Method of undetermined coefficients and variation of parameters. **L1,L3**

Module-3

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. **L1,L2**

Module-4

Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. Application to solutions of Linear differential equations and simultaneous differential equations. **L1,L2**

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. Bayes's theorem-examples. **L1,L2**

Course Outcomes: On completion of this course, students are able to:

- Solve systems of linear equations in the different areas of linear algebra.
- Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
- Describe Laplace transforms of standard and periodic functions.
- Determine the general/complete solutions to linear ODE using inverse Laplace transforms.
- Recall basic concepts of elementary probability theory and, solve problems related

to the decision theory, synthesis and optimization of digital circuits.

Text Book:

B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

SIGNALS AND SYSTEMS
SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Understand the mathematical description of continuous and discrete time signals and systems.
- Analyze the signals in time domain using convolution difference/differential equations
- Classify signals into different categories based on their properties.
- Analyze Linear Time Invariant (LTI) systems in time and transform domains.
- Build basics for understanding of courses such as signal processing, control system and communication.

Module -1

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. **L1, L2, L3**

Module -2

Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.

L1, L2, L3

Module -3

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours).

Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours). **L1, L2, L3**

Module -4

Fourier Representation of aperiodic Signals:

FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours).

FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance (4 Hours).

Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours). **L1, L2, L3**

Module -5

Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems. **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals.
- Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
- Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.
- Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.
- Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems.

Text Book:

Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.

Reference Books:

1. **Michael Roberts**, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab**, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan**, "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga**, "Signals and Systems", Pearson/Sanguine Technical Publishers, 2004.

CONTROL SYSTEMS
SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC43	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Understand the basic features, configurations and application of control systems.
- Understand various terminologies and definitions for the control systems.
- Learn how to find a mathematical model of electrical, mechanical and electro-mechanical systems.
- Know how to find time response from the transfer function.
- Find the transfer function via Masons' rule.
- Analyze the stability of a system from the transfer function.

Module -1

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. **L1, L2, L3**

Module -2

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). **L1, L2, L3**

Module -3

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci. **L1, L2, L3**

Module -4

Frequency domain analysis and stability:

Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.

Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)

Introduction to lead, lag and lead-lag compensating networks (excluding design).

L1, L2, L3

Module -5

Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diagonalisation.

L1, L2, L3

Course Outcomes: At the end of the course, the students will be able to

- Develop the mathematical model of mechanical and electrical systems
- Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method
- Determine the time domain specifications for first and second order systems
- Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
- Determine the stability of a system in the frequency domain using Nyquist and bode plots
- Develop a control system model in continuous and discrete time using state variable techniques

Text Book:

J.Nagarath and M.Gopal, “ Control Systems Engineering”, New Age International (P) Limited, Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.

Reference Books:

1. “Modern Control Engineering,” K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.
2. “Automatic Control Systems”, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. “Feedback and Control System,” Joseph J Distefano III et al., Schaum’s Outlines, TMH, 2nd Edition 2007.

PRINCIPLES OF COMMUNICATION SYSTEMS

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Learn the concepts of random process and various types of noise.
- Evaluate the performance of the communication system in presence of noise.
- Analyze pulse modulation and sampling techniques.

Module – 1

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

SINGLE SIDE-BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television. (Chapter 3 of Text). **L1, L2, L3**

Module – 2

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver (refer Chapter 4 of Text). **L1, L2, L3**

Module – 3

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross-correlation functions (refer Chapter 5 of Text).

NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure (refer Section 6.7 of Text). **L1, L2, L3**

Module – 4

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM (refer Chapter 6 of Text). **L1, L2, L3**

Module – 5

DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing (refer Chapter 7 of Text), Application to Vocoder (refer Section 6.8 of Reference Book 1). **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Determine the performance of analog modulation schemes in time and frequency domains.
- Determine the performance of systems for generation and detection of modulated analog signals.
- Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms.
- Characterize the influence of channel on analog modulated signals
- Determine the performance of analog communication systems.
- Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

Text Book:

Communication Systems, Simon Haykins & Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

Reference Books:

1. **Modern Digital and Analog Communication Systems**, B. P. Lathi, Oxford University Press., 4th edition.
2. **An Introduction to Analog and Digital Communication**, Simon Haykins, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5.
3. **Principles of Communication Systems**, H.Taub & D.L.Schilling, TMH, 2011.
4. **Communication Systems**, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. **Communication Systems: Analog and Digital**, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

LINEAR INTEGRATED CIRCUITS**SEMESTER – IV (EC/TC)****[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC45	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04**Course objectives:** This course will enable students to:

- Define and describe various parameters of Op-Amp, its characteristics and specifications.
- Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits.
- Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters.
- Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate.
- Describe and Sketch the various switching circuits of Op-Amps and analyze its operations.
- Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs.

Module – 1**Operational Amplifier Fundamentals:**

Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. **OP-Amps as DC Amplifiers** – Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet. **(Text1) L1, L2,L3**

Module – 2

Op-Amps as AC Amplifiers: Capacitor coupled voltage follower, High input impedance – Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier.

OP-Amp Applications: Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers.**(Text1) L1, L2,L3**

Module – 3

More Applications : Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. **(Text 1)**

Log and antilog amplifiers, Multiplier and divider. **(Text2) L1, L2,L3**

Module – 4

Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. **(Text 1)**

Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. **(Text 2) L1, L2,L3**

Module – 5

Phase locked loop: Basic Principles, Phase detector/comparator, VCO.

DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation.

Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and monostable multivibrator. **(Text 2) L1, L2,L3**

Course Outcomes: After studying this course, students will be able to:

- Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate.
- Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower.
- Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers.
- Test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider.
- Design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps.
- Explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.

Text Books:

1. “Operational Amplifiers and Linear IC’s”, David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.
2. “Linear Integrated Circuits”, D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.

Reference Books:

1. Ramakant A Gayakwad, “Op-Amps and Linear Integrated Circuits”, Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, “Linear Integrated Circuits: Analysis, Design & Applications,” Wiley India, 1st Edition, 2015.
3. James Cox, “Linear Electronics Circuits and Devices”, Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
4. Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.

MICROPROCESSORS
SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC46	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Familiarize basic architecture of 8086 microprocessor
- Program 8086 Microprocessor using Assembly Level Language
- Use Procedures in 8086 Programs
- Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design
- Understand the Von-Neumann, Harvard, CISC & RISC CPU architecture.

Module -1

8086 PROCESSOR: Historical background (refer Reference Book 1), 8086 CPU Architecture (1.1 – 1.3 of Text).

Addressing modes, Machine language instruction formats. (2.2, 2.1 of Text).

INSTRUCTION SET OF 8086: Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs (2.3 of Text). **L1, L2, L3**

Module -2

Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs (2.3, 2.4, 3.4 of Text). **L1, L2, L3**

Module -3

Stack and Interrupts:

Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Timing and Delays. (Chap. 4 of Text). **L1, L2, L3**

Module -4

8086 Bus Configuration and Timings:

Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams. (1.4 to 1.9 of Text).

Basic Peripherals and their Interfacing with 8086 (Part 1): Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing simple switches and simple LEDs using 8255 (Refer 5.3, 5.4, 5.5 of Text). **L1, L2, L3**

Module 5

Basic Peripherals and their Interfacing with 8086 (Part 2):

Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255 (5.6.1, 5.7.2, 5.8). Timer 8254 – Mode 0 & 3 and Interfacing programmes for these modes (refer 6.1 of Text).

INT 21H DOS Function calls - for handling Keyboard and Display (refer Appendix-B of Text).

Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture (refer Reference Book 1). **L1, L2, L3**

Course Outcomes: At the end of the course students will be able to:

- Explain the History of evolution of Microprocessors, Architecture and instruction set of 8086, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086.
- Write 8086 Assembly level programs using the 8086 instruction set
- Write modular programs using procedures.
- Write 8086 Stack and Interrupts programming.
- Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.
- Use INT 21 DOS interrupt function calls to handle Keyboard and Display.

Text Book:

Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

1. **Microprocessor and Interfacing**- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012.
2. **Microcomputer systems-The 8086 / 8088 Family** – Y.C. Liu and A. Gibson, 2nd edition, PHI -2003.
3. **The 8086 Microprocessor: Programming & Interfacing the PC** – Kenneth J Ayala, CENGAGE Learning, 2011.
4. **The Intel Microprocessor, Architecture, Programming and Interfacing** - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

MICROPROCESSOR LAB
SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	17ECL47	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	SEE Marks	60
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

Laboratory Experiments:

1. Programs involving:

Data transfer instructions like:

- i) Byte and word data transfer in different addressing Modes
- ii) Block move (with and without overlap)
- iii) Block interchange

2. Programs involving:

Arithmetic & logical operations like:

- i) Addition and Subtraction of multi precision nos.
- ii) Multiplication and Division of signed and unsigned Hexadecimal nos.
- iii) ASCII adjustment instructions.
- iv) Code conversions.

3. Programs involving:

Bit manipulation instructions like checking:

- i) Whether given data is positive or negative
- ii) Whether given data is odd or even
- iii) Logical 1's and 0's in a given data
- iv) 2 out 5 code
- v) Bit wise and nibble wise palindrome

4. Programs involving:

Branch/ Loop instructions like

- i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
- ii) Two application programs using Procedures and Macros (Subroutines).

5. Programs involving

String manipulation like string transfer, string reversing, searching for a string.

6. Programs involving

Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.

7. Interfacing Experiments:

Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)

1. Matrix keyboard interfacing
2. Seven segment display interface
3. Logical controller interface
4. Stepper motor interface
5. ADC and DAC Interface (8 bit)
6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches

Course Outcomes: On the completion of this laboratory course, the students will be able to:

- Write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations.
- Understand assembler directives, branch, loop operations and DOS 21H Interrupts.
- Write and execute 8086 assembly level programs to sort and search elements in a given array.
- Perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086.
- Utilize procedures and macros in programming 8086.
- Demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from software and one question from hardware interfacing to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

LINEAR ICS AND COMMUNICATION LAB

SEMESTER – IV (EC/TC)

[As per Choice Based Credit System (CBCS) Scheme]

Laboratory Code	17ECL48	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	SEE Marks	60
RBT Level	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to:

- Design, Demonstrate and Analyze instrumentation amplifier, filters, DAC, adder, differentiator and integrator circuits, using op-amp.
- Design, Demonstrate and Analyze multivibrators and oscillator circuits using Op-amp
- Design, Demonstrate and Analyze analog systems for AM, FM and Mixer operations.
- Design, Demonstrate and Analyze balance modulation and frequency synthesis.
- Demonstrate and Analyze pulse sampling and flat top sampling.

Laboratory Experiments:

1. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
2. Design of RC Phase shift and Wien's bridge oscillators using Op-amp.
3. Design active second order Butterworth low pass and high pass filters.
4. Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
5. Design Adder, Integrator and Differentiator using Op-Amp.
6. Design of Monostable and Astable Multivibrator using 555 Timer.
7. Demonstrate Pulse sampling, flat top sampling and reconstruction.
8. Amplitude modulation using transistor/FET (Generation and detection).
9. Frequency modulation using IC 8038/2206 and demodulation.
10. Design BJT/FET Mixer.
11. DSBSC generation using Balance Modulator IC 1496/1596.
12. Frequency synthesis using PLL.

Course Outcomes: This laboratory course enables students to:

- Illustrate the pulse and flat top sampling techniques using basic circuits.
- Demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses.
- Demonstrate AM and FM operations and frequency synthesis.
- Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C FIFTH SEMESTER SYLLABUS

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT			
B.E., V Semester, EC/TC/EI/BM/ML			
Course Code	15ES51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand basic skills of Management • Understand the need for Entrepreneurs and their skills • Understand Project identification and Selection • Identify the Management functions and Social responsibilities • Distinguish between management and administration 			
Module-1			
<p>Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).</p> <p>Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making(Selected topics from Chapters 4 & 5, Text 1). L1, L2</p>			
Module-2			
<p>Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staffing-Need and Importance, Recruitment and Selection Process (Selected topics from Chapters 7, 8 & 11,Text 1).</p> <p>Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow’s Need-Hierarchy Theory and Herzberg’s Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process (Selected topics from Chapters 15 to 18 and 9, Text 1). L1, L2</p>			
Module-3			
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).</p> <p>Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity</p>			

building for Entrepreneurship (Selected topics from Chapter 2, Text 2). **L1, L2**

Module-4

Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only) (Selected topics from Chapter 1, Text 2).

Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions (Selected topics from Chapter 4, Text 2). **L1, L2**

Module-5

Projects Management: A Project. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.

Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.

(Selected topics from Chapters 16 to 20 of Unit 3, Text 3). **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Understand the fundamental concepts of Management and Entrepreneurship
- Select a best Entrepreneurship model for the required domain of establishment
- Describe the functions of Managers, Entrepreneurs and their social responsibilities
- Compare various types of Entrepreneurs
- Analyze the Institutional support by various state and central government agencies

Text Books:

1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

Reference Book:

Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

DIGITAL SIGNAL PROCESSING

**B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC52	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Realization of FIR and IIR filters in different structural forms.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.

Module-1

Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution.

L1, L2

Module-2

Additional DFT properties, use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). **L1, L2, L3**

Module-3

Radix-2 FFT algorithm for the computation of DFT and IDFT—decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform. **L1, L2, L3**

Module-4

Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation. **L1, L2, L3**

Module-5

Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling structure, Lattice structure. FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Hanning and Bartlett windows. **L1, L2, L3**

Course Outcomes: After studying this course, students will be able to:

- Determine response of LTI systems using time domain and DFT techniques.
- Compute DFT of real and complex discrete time signals.
- Computation of DFT using FFT algorithms and linear filtering approach.
- Solve problems on digital filter design and realize using digital computations.

Text Book:

Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.

Reference Books:

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007.

VERILOG HDL			
B.E., V Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC53	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Differentiate between Verilog and VHDL descriptions. • Learn different Verilog HDL and VHDL constructs. • Familiarize the different levels of abstraction in Verilog. • Understand Verilog Tasks and Directives. • Understand timing and delay Simulation. • Learn VHDL at design levels of data flow, behavioral and structural for effective modeling of digital circuits. 			
Module-1			
<p>Overview of Digital Design with Verilog HDL Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. (Text1)</p> <p>Hierarchical Modeling Concepts Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1)</p> <p>L1, L2, L3</p>			
Module-2			
<p>Basic Concepts Lexical conventions, data types, system tasks, compiler directives. (Text1)</p> <p>Modules and Ports Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1) L1, L2, L3</p>			
Module-3			
<p>Gate-Level Modeling Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1)</p> <p>Dataflow Modeling Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1) L1, L2, L3</p>			
Module-4			
<p>Behavioral Modeling Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. (Text1) L1, L2, L3</p>			
Module-5			
<p>Introduction to VHDL Introduction: Why use VHDL?, Shortcomings, Using VHDL for Design Synthesis,</p>			

Design tool flow, Font conventions.

Entities and Architectures: Introduction, A simple design, Design entities, Identifiers, Data objects, Data types, and Attributes. (Text 2) **L1, L2, L3**

Course Outcomes: At the end of this course, students should be able to

- Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
- Write simple programs in VHDL in different styles.
- Design and verify the functionality of digital circuit/system using test benches.
- Identify the suitable Abstraction level for a particular digital design.
- Write the programs more effectively using Verilog tasks and directives.
- Perform timing and delay Simulation.

Text Books:

1. Samir Palnitkar, “**Verilog HDL: A Guide to Digital Design and Synthesis**”, Pearson Education, Second Edition.
2. Kevin Skahill, “**VHDL for Programmable Logic**”, PHI/Pearson education, 2006.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL” Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, “Design through Verilog HDL”, Wiley, 2016 or earlier.

INFORMATION THEORY AND CODING			
B.E., V Semester, Electronics & Communication Engineering / Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none"> • Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source. • Study various source encoding algorithms. • Model discrete & continuous communication channels. • Study various error control coding algorithms. 			
Module-1			
Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources (Section 4.1, 4.2 of Text 1). L1, L2, L3			
Module-2			
Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI (Section 2.2 of Text 2). Encoding of the Source Output, Shannon’s Encoding Algorithm (Sections 4.3, 4.3.1 of Text 1). Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm (Sections 3.6, 3.7, 3.8, 3.10 of Text 3). L1, L2, L3			
Module-3			
Information Channels: Communication Channels (Section 4.4 of Text 1). Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem, Contineuos Channels (Sections 4.2, 4.3, 4.4, 4.6, 4.7 of Text 3). L1, L2, L3			
Module-4			
Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array. Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Sections 9.1, 9.2, 9.3, 9.3.1, 9.3.2, 9.3.3 of Text 1). L1, L2, L3			
Module-5			

Some Important Cyclic Codes: Golay Codes, BCH Codes(Section 8.4 – Article 5 of Text 2).

Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5 – Articles 1,2 and 3, 8.6- Article 1 of Text 2). **L1, L2, L3**

Course Outcomes: At the end of the course the students will be able to:

- Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
- Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
- Model the continuous and discrete communication channels using input, output and joint probabilities
- Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
- Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Text Books:

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.

Reference Books:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
3. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. Information Theory and Coding, K.N.Haribhat, D.Ganesh Rao, Cengage Learning, 2017.

OPERATING SYSTEM

**B.E., V Semester, Electronics & Communication Engineering /
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC553	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the services provided by an operating system.
- Understand how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Understand the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

Module-1

Introduction to Operating Systems

OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems (Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text). **L1, L2**

Module-2

Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Long term, medium term and short term scheduling in a time sharing system (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, 4.2, 4.3, 4.4.1 of Text). **L1, L2**

Module-3

Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies (Topics from Sections 5.5 to 5.9, 6.1 to 6.3, except Optimal policy and 6.3.1 of Text). **L1, L2**

Module-4

File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from Sections 7.1 to 7.8 of Text). **L1, L2, L3**

Module-5

Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Resource state modelling, Deadlock detection algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text). **L1, L2, L3**

Course outcomes: After studying this course, students will be able to:

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods.

Text Book:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition, 2001.
2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

OBJECT ORIENTED PROGRAMMING USING C++
B.E. V Semester (Open Elective)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC562	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hrs/ Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Define Encapsulation, Inheritance and Polymorphism.
- Solve the problem with object oriented approach.
- Analyze the problem statement and build object oriented system model.
- Describe the characters and behavior of the objects that comprise a system.
- Explain function overloading, operator overloading and virtual functions.
- Discuss the advantages of object oriented programming over procedure oriented programming.

Module -1

Beginning with C++ and its features:

What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from Ch -2,3 of Text). **L1, L2**

Module -2

Functions, classes and Objects:

Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions (Selected Topics from Chap-4,5 of Text). **L1, L2, L3**

Module -3

Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text). **L1, L2, L3**

Module -4

Inheritance, Pointers, Virtual Functions, Polymorphism:

Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text). **L1, L2, L3**

Module -5

Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text). **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Explain the basics of Object Oriented Programming concepts.
- Apply the object initialization and destroy concept using constructors and destructors.
- Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
- Use the concept of inheritance to reduce the length of code and evaluate the usefulness.
- Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
- Use I/O operations and file streams in programs.

Text Book:

Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

Reference Book:

Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.

DSP LAB
B.E., V Semester, ELECTRONICS & COMMUNICATION ENGINEERING /
TELECOMMUNICATION ENGINEERING
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17ECL57	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory=03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS – 02

- Course Objectives:** This course will enable students to
- Simulate discrete time signals and verification of sampling theorem.
 - Compute the DFT for a discrete signal and verification of its properties using MATLAB.
 - Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
 - Compute and display the filtering operations and compare with the theoretical values.
 - Implement the DSP computations on DSP hardware and verify the result.

Laboratory Experiments

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine).
6. (i) Verification of DFT properties (like Linearity and Parsevals theorem, etc.)
(ii) DFT computation of square pulse and Sinc function etc.
7. Design and implementation of FIR filter to meet given specifications (using different window techniques).
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

9. Linear convolution of two sequences
10. Circular convolution of two sequences
11. N-point DFT of a given sequence
12. Impulse response of first order and second order system
13. Implementation of FIR filter

Course Outcomes: On the completion of this laboratory course, the students will be able to:

- Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
- Modelling of discrete time signals and systems and verification of its properties and results.
- Implementation of discrete computations using DSP processor and verify the results.
- Realize the digital filters using a simulation tool and a DSP processor and verify the frequency and phase response.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

HDL LAB
B.E., V Semester, ELECTRONICS & COMMUNICATION ENGINEERING /
TELECOMMUNICATION ENGINEERING
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17ECL58	CIE Marks	40
Number of Lecture Hours/Week	01 Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course Objectives: This course will enable students to:

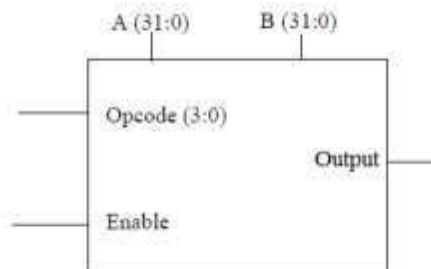
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD boards such as Apex/Acex/Max/Spartan/Sinfi or equivalent and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

Part-A: PROGRAMMING

1. Write Verilog code to realize all the logic gates
2. Write a Verilog program for the following combinational designs
 - a. 2 to 4 decoder
 - b. 8 to 3 (encoder without priority & with priority)
 - c. 8 to 1 multiplexer.
 - d. 4 bit binary to gray converter
 - e. Multiplexer, de-multiplexer, comparator.
3. Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Write a Verilog code to model 32 bit ALU using the schematic diagram shown below



- ALU should use combinational logic to calculate an output based on the four bit op-code input.
- ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.
- ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU Operation
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XOR B

5. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
6. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and “any sequence” counters, using Verilog code.

Part-B: INTERFACING (at least four of the following must be covered using VHDL/Verilog)

1. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
3. Write HDL code to control speed, direction of DC and Stepper motor.
4. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.) using DAC - change the frequency.
6. Write HDL code to simulate Elevator operation.

Course Outcomes: At the end of this course, students should be able to:

- Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C SIXTH SEMESTER SYLLABUS

DIGITAL COMMUNICATION			
B.E., VI Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC61	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours/Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: The objectives of the course is to enable students to:</p> <ul style="list-style-type: none"> • Understand the mathematical representation of signal, symbol, noise and channels. • Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks. • Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions. • Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions. 			
Module-1			
<p>Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p>Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2) L1, L2, L3</p>			
Module-2			
<p>Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4). L1, L2, L3</p>			
Module-3			
<p>Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-ary PSK, M-ary QAM (Relevant topics in Text 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without</p>			

derivation of probability of error equation) (Text 1: 7.11, 7.12. 7.13). L1, L2, L3
Module-4
Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol-by-Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2). Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2). L1, L2, L3
Module-5
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2). L1, L2, L3
Course Outcomes: At the end of the course, the students will be able to: <ul style="list-style-type: none"> • Associate and apply the concepts of Bandpass sampling to well specified signals and channels. • Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels. • Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels. • Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria.
Text Books: <ol style="list-style-type: none"> 1. Simon Haykin, “Digital Communication Systems”, John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5. 2. John G Proakis and Masoud Salehi, “Fundamentals of Communication Systems”, 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
Reference Books: <ol style="list-style-type: none"> 1. B.P.Lathi and Zhi Ding, “Modern Digital and Analog communication Systems”, Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2. 2. Ian A Glover and Peter M Grant, “Digital Communications”, Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7. 3. John G Proakis and Masoud Salehi, “Communication Systems Engineering”, 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.

ARM MICROCONTROLLER & EMBEDDED SYSTEMS

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC62	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.
- Program ARM Cortex M3 using the various instructions and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Module-1

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3) **L1, L2**

Module-2

ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) **L1, L2, L3**

Module-3

Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.
(Text 2: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). **L1, L2, L3**

Module-4

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language).
(Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only) **L1, L2, L3**

Module-5

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques
(Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

L1, L2, L3

Course outcomes: After studying this course, students will be able to:

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2nd Edition.

VLSI DESIGN			
B.E., VI Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC63	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: The objectives of the course is to enable students to:</p> <ul style="list-style-type: none"> • Impart knowledge of MOS transistor theory and CMOS technologies • Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology • Cultivate the concepts of subsystem design processes • Demonstrate the concepts of CMOS testing 			
Module-1			
<p>Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2).</p> <p>Fabrication: nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1). L1, L2</p>			
Module-2			
<p>MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout.</p> <p>Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1). L1, L2, L3</p>			
Module-3			
<p>Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters</p> <p>Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes- Regularity, Design of an ALU Subsystem, The Manchester Carry-chain and Adder Enhancement Techniques(5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1). L1, L2, L3</p>			
Module-4			
<p>Subsystem Design: Some Architectural Issues, Switch Logic, Gate(restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1).</p> <p>FPGA Based Systems: Introduction, Basic concepts, Digital design and FPGA's, FPGA based System design, FPGA architecture, Physical design for FPGA's (1.1 to 1.4, 3.2, 4.8 of TEXT3). L1, L2, L3</p>			
Module-5			
<p>Memory, Registers and Aspects of system Timing- System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).</p> <p>Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2). L1, L2, L3</p>			

Course outcomes: At the end of the course, the students will be able to:

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Interpret Memory elements along with timing considerations
- Demonstrate knowledge of FPGA based system design
- Interpret testing and testability issues in VLSI Design
- Analyze CMOS subsystems and architectural issues with the design constraints.

Text Books:

1. **“Basic VLSI Design”**- Douglas A. Pucknell& Kamran Eshraghian, PHI 3rd Edition (original Edition – 1994).
2. **“CMOS VLSI Design- A Circuits and Systems Perspective”**- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
3. **“FPGA Based System Design”**- Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

COMPUTER COMMUNICATION NETWORKS			
B.E., VI Semester, Electronics & Communication Engineering / Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC64	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the layering architecture of OSI reference model and TCP/IP protocol suite. • Understand the protocols associated with each layer. • Learn the different networking architectures and their representations. • Learn the various routing techniques and the transport layer services. 			
Module-1			
Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet.			
Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.			
Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. L1, L2			
Module-2			
Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing.			
Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. L1, L2			
Module-3			
Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers.			
Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages.			
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. L1, L2			
Module-4			
Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation,			

Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging Tools, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. **L1, L2, L3**

Module-5

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. **L1, L2**

Course Outcomes: At the end of the course, the students will be able to:

- Identify the protocols and services of Data link layer.
- Identify the protocols and functions associated with the transport layer services.
- Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
- Distinguish the basic network configurations and standards associated with each network.
- Construct a network model and determine the routing of packets using different routing algorithms.

Text Book:

Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016
ISBN: 1-25-906475-3

Reference Books:

1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4
2. Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282

ARTIFICIAL NEURAL NETWORKS

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC653	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS - 03

Course Objectives: The objectives of this course are:

- Understand the basics of ANN and comparison with Human brain
- Provide knowledge on Generalization and function approximation and various architectures of building an ANN
- Provide knowledge of reinforcement learning using neural networks
- Provide knowledge of unsupervised learning using neural networks.

Module-1

Introduction: Biological Neuron – Artificial Neural Model - Types of activation functions – **Architecture:** Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks.

Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem. **L1, L2**

Module-2

Supervised Learning: Perceptron learning and Non Separable sets, α -Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ -LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Backpropagation Learning Algorithm, Practical consideration of BP algorithm. **L1, L2, L3**

Module-3

Support Vector Machines and Radial Basis Function: Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition. **L1, L2, L3**

Module-4

Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory. **L1, L2, L3**

Module-5

Self-organization Feature Map: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas. **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2. Understand the concepts and techniques of neural networks through the study of important neural network models.
3. Evaluate whether neural networks are appropriate to a particular application.
4. Apply neural networks to particular application.
5. Analyze the steps needed to improve performance of the selected neural network.

Text Book:

Neural Networks A Classroom Approach– Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. **Introduction to Artificial Neural Systems**-J.M. Zurada, Jaico Publications 1994.
2. **Artificial Neural Networks**-B. Yegnanarayana, PHI, New Delhi 1998.

EMBEDDED CONTROLLER LAB

**B.E., VI Semester, Electronics & Communication Engineering/
Telecommunication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17ECL67	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Laboratory Experiments

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display “Hello World” message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

Course outcomes: After studying this course, students will be able to:

- Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
- Develop assembly language programs using ARM Cortex M3 for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- Develop C language programs and library functions for embedded system applications.

Conduction of Practical Examination:

1. PART-B experiments using Embedded-C are only to be considered for the practical examination. PART-A ALP programs are for study purpose and can be considered for Internal Marks evaluation.
2. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
3. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

COMPUTER NETWORKS LAB			
B.E., VI Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17ECL68	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Choose suitable tools to model a network and understand the protocols at various OSI reference levels. • Design a suitable network and simulate using a Network simulator tool. • Simulate the networking concepts and protocols using C/C++ programming. • Model the networks for different configurations and analyze the results. 			
Laboratory Experiments			
PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool			
<ol style="list-style-type: none"> 1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth. 2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP. 3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate. 4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations. 5. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters. 6. Implementation of Link state routing algorithm. 			
PART-B: Implement the following in C/C++			
<ol style="list-style-type: none"> 1. Write a program for a HLDC frame to perform the following. <ol style="list-style-type: none"> i) Bit stuffing ii) Character stuffing. 2. Write a program for distance vector algorithm to find suitable path for transmission. 			

3. Implement Dijkstra's algorithm to compute the shortest routing path.
4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
 - a. Without error
 - b. With error
5. Implementation of Stop and Wait Protocol and Sliding Window Protocol
6. Write a program for congestion control using leaky bucket algorithm.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Use the network simulator for learning and practice of networking algorithms.
- Illustrate the operations of network protocols and algorithms using C programming.
- Simulate the network with different configurations to measure the performance parameters.
- Implement the data link and routing protocols using C programming.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination one question from software and one question from hardware or only one hardware experiments based on the complexity to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

6th Semester Open Electives Syllabus for the Courses Offered by EC/TC

Board:

DATA STRUCTURE USING C++
B.E VI Semester (Open Elective)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17EC661	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hrs per Module)	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues, Lists
- Analyze Non Linear Data Structures: Trees
- Assess appropriate data structure during program development/Problem Solving

Module -1

INTRODUCTION: Functions and parameters, Dynamic memory allocation, Recursion.
LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. **L1, L2**

Module -2

ARRAYS AND MATRICES: Arrays, Matrices, Special matrices, Sparse matrices.

STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Paranthesis Matching & Towers of Hanoi. **L1, L2, L3**

Module -3

QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement.

HASHING: Dictionaries, Linear representation, Hash table representation. **L1, L2, L3**

Module -4

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. **L1, L2, L3**

Module -5

Priority Queues: Linear lists, Heaps, Applications-Heap Sorting.

Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates. **L1, L2, L3**

Course outcomes: After studying this course, students will be able to:

- Acquire knowledge of Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
- Understand non Linear data structures trees and their applications
- Design appropriate data structures for solving computing problems
- Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++**, Sartaj Sahni, Mc. Graw Hill, 2000.
2. **Object Oriented Programming with C++**, E.Balaguruswamy, TMH, 6th Edition, 2013.
3. **Programming in C++**, E.Balaguruswamy. TMH, 4th, 2010.

B.E E&C SEVENTH SEMESTER SYLLABUS

MICROWAVES AND ANTENNAS			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC71	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Describe the microwave properties and its transmission media • Describe microwave devices for several applications • Understand the basics of antenna theory • Select antennas for specific applications 			
Module-1			
<p>Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.2)</p> <p>Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient, Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching) L1, L2</p>			
Module-2			
<p>Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3)</p> <p>Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16) L1, L2</p>			
Module-3			
<p>Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11)</p> <p>Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13, 2.15) L1, L2, L3</p>			
Module-4			

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.(Text 3: 5.1 – 5.11, 5.13)

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of $\lambda/2$ Antenna. (Text 3: 6.1 -6.6)

L1, L2, L3, L4

Module-5

Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas.(Text 3: 7.1-7.8, 7.19, 7.20)

Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7) **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- Describe the use and advantages of microwave transmission
- Analyze various parameters related to microwave transmission lines and waveguides
- Identify microwave devices for several applications
- Analyze various antenna parameters necessary for building an RF system
- Recommend various antenna configurations according to the applications

Text Books:

1. **Microwave Engineering** – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. **Microwave Devices and circuits-** Liao, Pearson Education.
3. **Antennas and Wave Propagation**, John D. Krauss, Ronald J Marhefka and Ahmad S Khan,4th Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. **Microwave Engineering** – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. **Microwave Engineering** – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. **Antennas and Wave Propagation** – Harish and Sachidananda: Oxford University Press, 2007.

DIGITAL IMAGE PROCESSING			
B.E., VII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC72	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: The objectives of this course are to: <ul style="list-style-type: none"> • Understand the fundamentals of digital image processing • Understand the image transform used in digital image processing • Understand the image enhancement techniques used in digital image processing • Understand the image restoration techniques and methods used in digital image processing • Understand the Morphological Operations and Segmentation used in digital image processing 			
Module-1			
Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. [Text: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2] L1, L2			
Module-2			
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. [Text: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10] L1, L2, L3			
Module-3			
Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. [Text: Chapter 5: Sections 5.2, to 5.9] L1, L2, L3			
Module-4			

<p>Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.</p> <p>Wavelets: Background, Multiresolution Expansions.</p> <p>Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms. [Text: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5] L1, L2, L3</p>
Module-5
<p>Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.</p> <p>Representation and Description: Representation, Boundary descriptors. [Text: Chapter 10: Sections 10.2, to 10.5 and Chapter 11: Sections 11.1 and 11.2] L1, L2, L3</p>
<p>Course Outcomes: At the end of the course students should be able to:</p> <ul style="list-style-type: none"> • Understand image formation and the role human visual system plays in perception of gray and color image data. • Apply image processing techniques in both the spatial and frequency (Fourier) domains. • Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation. • Conduct independent study and analysis of Image Enhancement techniques.
<p>Text Book: Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.</p>
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014. 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

POWER ELECTRONICS

**B.E., VII Semester, Electronics & Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]**

Course Code	17EC73	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours / Module)	Exam Hours	03

CREDITS – 04

Course Objectives: This course will enable students to:

- Understand the construction and working of various power devices.
- Study and analysis of thyristor circuits with different triggering conditions.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Study of power electronics circuits under various load conditions.

Module-1

Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits, Peripheral Effects. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics, di/dt and dv/dt limitations. (Text 1) **L1, L2**

Module-2

Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit, UJT Firing Circuit. (Text 2) **L1, L2, L3**

Module-3

Controlled Rectifiers - Introduction, Principle of Phase-Controlled Converter Operation, Single-Phase Full Converter with RL Load, Single-Phase Dual Converters, Single-Phase Semi Converter with RL load.
AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase controllers with resistive and inductive loads. (Text 1) **L1, L2, L3**

Module-4

DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators, Chopper circuit design. (Text 1) **L1, L2**

Module-5

Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter, Inverter circuit design.
Static Switches: Introduction, Single phase AC switches, DC Switches, Solid state relays, Microelectronic relays. (Text 1) **L1, L2**

Course Outcomes: At the end of the course students should be able to:

- Describe the characteristics of different power devices and identify the various applications associated with it.
- Illustrate the working of power circuit as DC-DC converter.
- Illustrate the operation of inverter circuit and static switches.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least 4 experiments of Power Electronics to be conducted by the students. This activity can be considered for the evaluation of 10 marks out of 40 Continuous Internal Evaluation marks, reserved for the other activities.

Text Books:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, ePub eBook.

REAL TIME SYSTEMS			
B.E., VII Semester, Electronics & Communication Engineering			
/Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC743	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
Credits – 03			
Course Objectives: This Course will enable students to: <ul style="list-style-type: none"> • Discuss the historical background of Real-time systems and its classifications. • Describe the concepts of computer control and hardware components for Real-Time Application. • Discuss the languages to develop software for Real-Time Applications. • Explain the concepts of operating system and RTS development methodologies. 			
Module-1			
Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.			
Concepts of Computer Control: Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text Book: 1.1 to 1.6 and 2.1 to 2.6) L1, L2			
Module-2			
Computer Hardware Requirements for Real-Time Applications: Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.(Text Book: 3.1 to 3.8) L1, L2			
Module-3			
Languages for Real-Time Applications: Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. (Text Book: 5.1 to 5.14) L1, L2, L3			
Module-4			
Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.(Text Book: 6.1 to 6.11) L1, L2			
Module-5			
Design of RTS – General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.			
RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hatley and Pirbhai Method. (Text Book: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5) L1, L2, L3			

Course Outcomes: At the end of the course, students should be able to:

- Understand the fundamentals of Real time systems and its classifications.
- Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications.
- Develop the software languages to meet Real time applications.
- Apply suitable methodologies to design and develop Real-Time Systems.

Text Book:

Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.

Reference Books:

1. C.M. Krishna, Kang G. Shin, “Real –Time Systems”, McGraw –Hill International Editions, 1997.
2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.
3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005.

DSP ALGORITHMS and ARCHITECTURE			
B.E., VII Semester, Electronics & Communication Engineering			
/Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC751	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Figure out the knowledge and concepts of digital signal processing techniques. • Understand the computational building blocks of DSP processors and its speed issues. • Understand the various addressing modes, peripherals, interrupts and pipelining structure of TMS320C54xx processor. • Learn how to interface the external devices to TMS320C54xx processor in various modes. • Understand basic DSP algorithms with their implementation. 			
Module-1			
Introduction to Digital Signal Processing:			
Introduction, A Digital Signal – Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.			
Computational Accuracy in DSP Implementations:			
Number Formats for Signals and Coefficients in DSP Systems, Dynamic Range and Precision, Sources of Error in DSP Implementation. L1, L2			
Module-2			
Architectures for Programmable Digital Signal – Processing Devices:			
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing. L1, L2, L3			
Module-3			
Programmable Digital Signal Processors:			
Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54XX, Memory Space of TMS320C54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On – Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor. L1, L2, L3			
Module-4			

Implementation of Basic DSP Algorithms:

Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

Implementation of FFT Algorithms:

Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS320C54xx. **L1, L2, L3**

Module-5**Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices:**

Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O Direct Memory Access (DMA).

Interfacing and Applications of DSP Processors:

Introduction, Synchronous Serial Interface, A CODEC Interface Circuit, DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.

L1, L2, L3

Course Outcomes: At the end of this course, students would be able to

- Comprehend the knowledge and concepts of digital signal processing techniques.
- Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.
- Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
- Develop basic DSP algorithms using DSP processors.
- Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device.
- Demonstrate the programming of CODEC interfacing.

Text Book:

“Digital Signal Processing”, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

Reference Books:

1. “Digital Signal Processing: A practical approach”, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. “Digital Signal Processors”, B Venkataramani and M Bhaskar, TMH, 2nd, 2010
3. “Architectures for Digital Signal Processing”, Peter Pirsch John Wiley, 2008

ADVANCED COMMUNICATION LAB
B.E., VII Semester, Electronics & Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17ECL76	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Design and demonstrate the digital modulation techniques
- Demonstrate and measure the wave propagation in microstrip antennas
- Characteristics of microstrip devices and measurement of its parameters.
- Model an optical communication system and study its characteristics.
- Simulate the digital communication concepts and compute and display various parameters along with plots/figures.

Laboratory Experiments

PART-A: Following Experiments No. 1 to 4 has to be performed using discrete components.

1. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
2. ASK generation and detection
3. FSK generation and detection
4. PSK generation and detection
5. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
6. Measurement of directivity and gain of microstrip dipole and Yagi antennas.
7. Determination of
 - a. Coupling and isolation characteristics of microstrip directional coupler.
 - b. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
 - c. Power division and isolation of microstrip power divider.
8. Measurement of propagation loss, bending loss and numerical aperture of an optical fiber.

PART-B: Simulation Experiments using SCILAB/MATLAB/Simulink or LabView

1. Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polar signaling.
2. Simulate the Pulse code modulation and demodulation system and display the waveforms.
3. Simulate the QPSK transmitter and receiver. Plot the signals and its constellation diagram.
4. Test the performance of a binary differential phase shift keying system by simulating the non-coherent detection of binary DPSK.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Determine the characteristics and response of microwave devices and optical waveguide.
- Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
- Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
- Design and test the digital modulation circuits/systems and display the waveforms.

Conduct of Practical Examination:

- All laboratory experiments are to be considered for practical examination.
- For examination one question from **PART-A** and one question from **PART-B** or only one question from **PART-B** experiments based on the complexity, to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

VLSI LAB
B.E., VII Semester, Electronics & Communication Engineering
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	17ECL77	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory = 03	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

CREDITS - 02

Course objectives: This course will enable students to:

- Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
- Learn DRC, LVS and Parasitic Extraction of the various designs.
- Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.

Experiments can be conducted using any of the following or equivalent design tools: Cadence/Synopsis/Mentor Graphics/Microwind

Laboratory Experiments

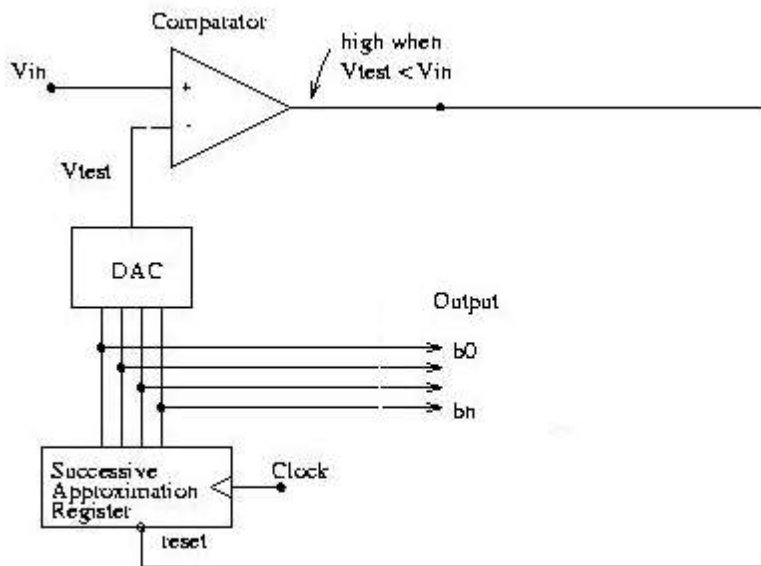
PART - A
ASIC-DIGITAL DESIGN

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
 - i. An inverter
 - ii. A Buffer
 - iii. Transmission Gate
 - iv. Basic/universal gates
 - v. Flip flop -RS, D, JK, MS, T
 - vi. Serial & Parallel adder
 - vii. 4-bit counter [Synchronous and Asynchronous counter]
 - viii. Successive approximation register [SAR]

PART - B
ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and (ii) A Single Stage differential amplifier, with given specifications**, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.
[Specifications to GDS-II]



- * An appropriate constraint should be given.
- ** Appropriate specification should be given.
- *** Applicable Library should be added & information should be given to the Designer.

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, one question from **PART-A** and one question from **PART-B** to be set.
- Students are allowed to pick one experiment from the lot.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

B.E E&C EIGHTH SEMESTER SYLLABUS

WIRELESS CELLULAR and LTE 4G BROADBAND			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC81	CIE Marks	40
Number of Lecture	04	SEE Marks	60
Total Number	50 (10 Hours / Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the basics of LTE standardization phases and specifications. • Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles. • Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer. • Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth. 			
Module – 1			
<p>Key Enablers for LTE features: OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, IP based Flat network Architecture, LTE Network Architecture. (Sec 1.4- 1.5 of Text).</p> <p>Wireless Fundamentals: Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading (Sec 2.2 – 2.7of Text). L1, L2</p>			
Module – 2			
<p>Multicarrier Modulation: OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE (Sec 3.2 – 3.6 of Text).</p> <p>OFDMA and SC-FDMA:OFDM with FDMA,TDMA,CDMA, OFDMA, SC-FDMA, OFDMA and SC-FDMA in LTE (Sec 4.1 – 4.3, 4.5 of Text).</p> <p>Multiple Antenna Transmission and Reception: Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Spatial Multiplexing, Choice between Diversity, Interference suppression and Spatial Multiplexing (Sec 5.1 – 5.6 of Text). L1, L2</p>			
Module – 3			
<p>Overview and Channel Structure of LTE: Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink SC-FDMA Radio Resource(Sec 6.1 – 6.4 of Text).</p> <p>Downlink Transport Channel Processing: Overview, Downlink shared</p>			

channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink(Sec 7.1 – 7.7 of Text). **L1, L2**

Module – 4

Uplink Channel Transport Processing: Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels, H-ARQ on uplink (Sec 8.1 – 8.6 of Text).

Physical Layer Procedures: Hybrid – ARQ procedures, Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink(Sec 9.1- 9.6, 9.8, 9.9, 9.10 Text). **L1, L2**

Module – 5

Radio Resource Management and Mobility Management:

PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination (Sec 10.1 – 10.5 of Text). **L1, L2**

Course Outcomes: At the end of the course, students will be able to:

- Understand the system architecture and the functional standard specified in LTE 4G.
- Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
- Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
- Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Text Book:

Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, 'Fundamentals of LTE', Prentice Hall, Communications Engg. and Emerging Technologies.

Reference Books:

1. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003.
2. 'EVOLVED PACKET SYSTEM (EPS) ; THE LTE AND SAE EVOLUTION OF 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print ISBN:978-0-470-05976-0.
3. 'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd, ISBN 978-0-470-69716-0.

FIBER OPTICS and NETWORKS			
B.E., VIII Semester, Electronics & Communication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC82	CIE Marks	40
Number of Lecture Hours/Week	4	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours / Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn the basic principle of optical fiber communication with different modes of light propagation. • Understand the transmission characteristics and losses in optical fiber. • Study of optical components and its applications in optical communication networks. • Learn the network standards in optical fiber and understand the network architectures along with its functionalities. 			
Module -1			
<p>Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 2) L1, L2</p>			
Module -2			
<p>Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.</p> <p>Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers. (Text 2) L1, L2</p>			
Module -3			
<p>Optical sources: Energy Bands, Direct and Indirect Bandgaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and Radiation Patterns: Single mode lasers.</p> <p>Photodetectors: Physical principles of Photodiodes, Photodetector noise, Detector response time.</p> <p>Optical Receiver: Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 1) L1, L2</p>			
Module -4			

WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources,

Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 1) **L1, L2**

Module -5

Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks, Optical network deployment: Long-haul networks, Metropolitan area networks, Access networks, Local area networks. (Text 2) **L1, L2**

Course Outcomes: At the end of the course, students will be able to:

1. Classification and working of optical fiber with different modes of signal propagation.
2. Describe the transmission characteristics and losses in optical fiber communication.
3. Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4. Describe the constructional features and the characteristics of optical sources and detectors.
5. Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Text Books:

1. Gerd Keiser , Optical Fiber Communication, 5th Edition, McGraw Hill Education(India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Book:

Joseph C Palais, Fiber Optic Communication , Pearson Education, 2005, ISBN:0130085103

RADAR ENGINEERING			
B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering			
[As per Choice Based Credit System (CBCS) Scheme]			
Course Code	17EC833	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the Radar fundamentals and analyze the radar signals. • Understand various technologies involved in the design of radar transmitters and receivers. • Learn various radars like MTI, Doppler and tracking radars and their comparison 			
Module-1			
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power.			
Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. (Chapter 1 of Text) L1, L2, L3			
Module-2			
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection,			
Radar Cross Section of Targets: simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. (Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11) L1, L2, L3			
Module-3			
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler,			
Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. (Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text) L1, L2, L3			
Module-4			
Tracking Radar:			
Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking-Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse.			
Sequential Lobing, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers. (Chapter 4: 4.1, 4.2, 4.3 of Text) L1, L2, L3			
Module-5			
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (Chapter 9: 9.1, 9.2 9.4,			

9.5 of Text)

Radar Receiver: The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. (Chapter 11 of Text)

L1, L2, L3

Course outcomes: At the end of the course, students will be able to:

- Understand the radar fundamentals and radar signals.
- Explain the working principle of pulse Doppler radars, their applications and limitations
- Describe the working of various radar transmitters and receivers.
- Analyze the range parameters of pulse radar system which affect the system performance

Text Book:

Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.

Reference Books:

1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. HoIm. Yesdee, 2013

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SCHEME OF TEACHING & EXAMINATION

III

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code	Title	Teaching Dept.	Teaching hours/week		Duration in hours	Examination		
			Theory	Practical		I. A	Marks	
							Theory/ Practical	Total Marks
10MAT - 31	Engineering Mathematics - III	Mat	04		03	25	100	125
10ES – 32	Analog Electronic Circuits	@	04		03	25	100	125
10ES – 33	Logic Design	@	04		03	25	100	125
10ES – 34	Network Analysis	@	04		03	25	100	125
10EE– 35	Electrical and Electronic Measurements And Instrumentation	E&EE	04		03	25	100	125
10EE – 36	Electric Power Generation	E&EE	04		03	25	100	125
10ESL – 37	Analog Electronics Lab	@		03	03	25	50	75
10ESL – 38	Logic Design Lab	@		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

FINAL SCHEME OF TEACHING & EXAMINATION- Dated 16th and 17th April 2010

IV

**SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT - 41	Engineering Mathematics - IV	Mat	04		03	25	100	125
10ES- 42	Microcontrollers	@	04		03	25	100	125
10ES - 43	Control Systems	@	04		03	25	100	125
10EE - 44	Field Theory	E&EE	04		03	25	100	125
10EE- 45	Power Electronics	E&EE	04		03	25	100	125
10EE - 46	Transformers and Induction Machines	E&EE	04		03	25	100	125
10ESL - 47	Microcontrollers Lab	@		03	03	25	50	75
10EEL - 48	Power Electronics Lab	E&EE		03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline.ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

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V

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	@	4	-	3	25	100	125
02	10EE52	Signals and Systems	E&EE	4	-	3	25	100	125
03	10EE53	Transmission and Distribution	E&EE	4	-	3	25	100	125
04	10EE54	D.C. Machines and Synchronous Machines	E&EE	4	-	3	25	100	125
05	10EE55	Modern Control theory	E&EE	4	-	3	25	100	125
06	10EE56	Linear IC's and Applications	E&EE	4	-	3	25	100	125
07	10EEL57	Measurements and Circuit Simulation Laboratory	E&EE	-	3	3	25	50	75
08	10EEL58	Transformers and Induction Machines Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

@ Any Engineering department or department of Business study.

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VI

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching		Examination			
				Hrs / Week		Duration (Hrs)	Marks		
				Theory	Practical		IA	Theory / Practical	Total
1	10EE61	Power System Analysis and Stability	E&EE	4	-	3	25	100	125
2	10EE62	Switchgear & Protection	E&EE	4	-	3	25	100	125
3	10EE63	Electrical Machine Design	E&EE	4	-	3	25	100	125
4	10EE64	Digital Signal Processing	E&EE	4	-	3	25	100	125
5	10EE65	Computer Aided Electrical Drawing	E&EE	1	3	3	25	100	125
6	10EE66X	Elective-I (Group A)	E&EE	4	-	3	25	100	125
7	10EEL67	D.C. Machines and Synchronous Machines Laboratory	E&EE	-	3	3	25	50	75
8	10EEL68	Control Systems Laboratory	E&EE	-	3	3	25	50	75
Total				21	09	24	200	700	900

Elective-I (Group A)

10EE661-Operation Research

10EE662 - Advanced Power Electronics

10EE663 – Fuzzy Logic

10EE664 - Object Oriented Programming using C++

10EE665 - Embedded Systems

10EE666 – Electrical Engineering Materials

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VII

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE71	Computer Techniques in Power System Analysis	E&EE	4	-	3	25	100	125
2	10EE72	Electrical Power Utilization	E&EE	4	-	3	25	100	125
3	10EE73	High Voltage Engineering	E&EE	4	-	3	25	100	125
4	10EE74	Industrial Drives and Applications	E&EE	4	-	3	25	100	125
5	10EE75X	Elective-II (Group B)	E&EE	4	-	3	25	100	125
6	10EE76X	Elective-III (Group C)	E&EE	4	-	3	25	100	125
7	10EEL77	Relay and High Voltage Laboratory	E&EE	-	3	3	25	50	75
8	10EEL78	Power System Simulation Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

Elective-II (Group B)

10EE751 - HVDC Transmission
 10EE752 - Programmable Logic Controllers
 10EE753 - Artificial Neural Network
 10EE754 - Operating System
 10EE755 - Digital System with VHDL
 10EE756 - Testing and Commissioning of Electrical Equipment

Elective-III (Group C)

10EE761 - Power System Planning
 10EE762 - Computer Control of Electrical Drives
 10EE763 - Data Structure
 10EE764 - VLSI Circuits and Design
 10EE765 - Micro & Smart System Technology
 10EE766 - Electromagnetic Compatibility

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VIII

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE81	Electrical Design, Estimation and Costing	E&EE	4	-	3	25	100	125
2	10EE82	Power System Operation and Control	E&EE	4	-	3	25	100	125
3	10EE83X	Elective-IV (Group D)	E&EE	4	-	3	25	100	125
4	10EE84X	Elective-V (Group E)	E&EE	4	-	3	25	100	125
5	10EEP85	Project Work	E&EE	-	6	3	100	100	200
6	10EES86	Seminar (on a latest topic relevant to the branch and independent of the project work)	E&EE	-	3	-	50	-	50
Total				16	09	15	250	500	750

Elective-IV (Group-D)

10EE831 - Reactive Power Management

10EE832 - Flexible A.C. Transmission Systems (FACTS)

10EE833- Advanced Instrumentation System

10EE834 - AI Applications to Power Systems

10EE835 - Data Base Management Systems (DBMS)

10EE836 - Renewable Energy Sources

Elective-V (Group-E)

10EE841 - Power Systems Dynamics and Stability

10EE842 - Energy Auditing & Demand Side Management

10EE843 - Data communications and Networking

10EE844 - Electrical Distribution Systems

10EE845 - Insulation Engineering

10EE846 - Intellectual Property Rights

10EE847 - Electrical Power Quality

ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31
Hrs/Week: 04
Total Hrs: 52

IA Marks: 25
Exam Hrs: 03
Exam Marks:100

PART-A

Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples*

Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. [7 hours]

Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms [6 hours]

Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation. [6 hours]

Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form $y = ax+b$, $y = a x^2 + b x + c$, $y = ae^{bx}$, $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method. [7 hours]

PART-B

Unit-V: NUMERICAL METHODS - 1

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

Unit-VI: NUMERICAL METHODS – 2

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

Unit-VII: NUMERICAL METHODS – 3

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations

[7 hours]

Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

Note: * In the case of illustrative examples, questions are not to be set.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd. Publishers

ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41

Hrs/Week: 04

Total Hrs: 52

IA Marks: 25

Exam Hrs: 03

Exam Marks:100

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order. Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions. Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, empirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

Unit-VII: PROBABILITY THEORY - 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

Unit-VIII: SAMPLING THEORY

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus-Dated 16th and 17th April 2010**SCHEME OF TEACHING & EXAMINATION****III****SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT31	Engineering Mathematics - III	Mat	04	-	03	25	100	125
10ES32	Analog Electronic Circuits	@	04	-	03	25	100	125
10ES33	Logic Design	@	04	-	03	25	100	125
10ES34	Network Analysis	@	04	-	03	25	100	125
10EE35	Electrical and Electronic Measurements And Instrumentation	E&EE	04	-	03	25	100	125
10EE36	Electric Power Generation	E&EE	04	-	03	25	100	125
10ESL37	Analog Electronics Lab	@	-	03	03	25	50	75
10ESL38	Logic Design Lab	@	-	03	03	25	50	75
Total			24	06	24	200	700	900

Note : @ indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to electrical and electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

10MAT31 ENGINEERING MATHEMATICS – III

Subject Code	:	10MAT31	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

**10ES32 ANALOG ELECTRONIC CIRCUITS
(Common to EC/TC/EE/IT/BM/ML)**

Subject Code	:	10ES32	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES33 LOGIC DESIGN (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES33	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES34 NETWORK ANALYSIS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES34	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT 1:**

Basic Concepts: Basic definitions. Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.

7 Hours**UNIT 2:**

Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, solution of resistive networks, principle of duality.

7 Hours**UNIT 3:**

Network Theorems – 1: Superposition, Reciprocity and Millman's theorems

6 Hours**UNIT 4:****Network Theorems - II:**

Thevenin's and Norton's theorems, Maximum Power transfer theorem

6 Hours**PART – B****UNIT 5:**

Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Q factor, Bandwidth.

6Hours**UNIT 6:**

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

7 Hours

UNIT 7:

Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis

7 Hours**UNIT 8:**

Two port network parameters: Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets

6 Hours**TEXT BOOKS:**

1. **Engineering Circuit Analysis**, Hayt, Kemmerly and Durbin, TMH, 7th Edition, 2010
2. **Networks and systems**, Roy Choudhury, New Age International Publications., 2nd edition, 2006 re-print,

REFERENCE BOOKS:

1. **Electric Circuits**, Schaum's Outlines, M Nahvi & J A Edminister, TMH, 5th Edition, 2009.
2. **Network Analysis**, M. E. Van Valkenburg, PHI, 3rd Edition, Reprint 2009.
3. **Analysis of Linear Systems**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002

10EE35 ELECTRICAL and ELECTRONIC MEASUREMENTS and INSTRUMENTATION

Subject Code	:	10EE35	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT 1:**

1-(a) Units and Dimensions: Review of fundamental and derived units. S.I. units. Dimensional equations, problems. **3 Hours**

1-(b) Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance, measurement by fall of potential method and by using Megger. **3 Hours**

UNIT 2:

Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance & capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. **07 Hours**

UNIT 3:

Extension of Instrument Ranges: Shunts and multipliers. Construction and theory of instrument transformers, Equations for ratio and phase angle errors of C.T. and P.T (derivations excluded). Turns compensation, illustrative examples (excluding problems on turns compensation), Silsbees's method of testing CT. **07 Hours**

UNIT 4:

Measurement of Power and Energy: Dynamometer wattmeter. UPF and LPF wattmeters, Measurement of real and reactive power in three-phase circuits. Induction type energy meter — construction, theory, errors, adjustments and calibration. Principle of working of electronic energy meter. **06 Hours**

PART – B**UNIT 5:**

(a) Construction and operation of electro-dynamometer single-phase power factor meter. Weston frequency meter and phase sequence indicator. **04 Hours**

(b) **Electronic Instruments:** Introduction. True RMS responding voltmeter. Electronic multimeters. Digital voltmeters. Q meter. **04 Hours**

UNIT 6:

Dual trace oscilloscope — front panel details of a typical dual trace oscilloscope. Method of measuring voltage, current, phase, frequency and period. Use of Lissajous patterns. Working of a digital storage oscilloscope. Brief note on current probes. **06 Hours**

UNIT 7:

Transducers: Classification and selection of transducers. Strain gauges. LVDT. Measurement of temperature and pressure. Photo-conductive and photo-voltaic cells. **06 Hours**

UNIT 8:

(a) Interfacing resistive transducers to electronic circuits. Introduction to data acquisition systems. **2 Hours**

(b) **Display Devices and Signal Generators:** X-Y recorders. Nixie tubes. LCD and LED display. Signal generators and function generators. **4 Hours**

Text Books

1. **Electrical and Electronic Measurements and Instrumentation**, A. K. Sawhney, Dhanpatrai and Sons, New Delhi.
2. **Modern Electronic Instrumentation and Measuring Techniques**, Cooper D. and A.D. Heifrick, PHI, 2009 Edition.

References

1. **Electronic Instrumentation and Measurement**, David A. Bell, oxford Publication ,2nd Edition, 2009.
2. **Electrical Measurements and Measuring Instruments**, Golding and Widdies, Pitman

10EE36 ELECTRIC POWER GENERATION

Subject Code	:	10EE36	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT 1:**

Sources of Electrical Power: Wind, solar, fuel cell, tidal, geo-thermal, hydro-electric, thermal-steam, diesel, gas, nuclear power plants (block diagram approach only). Concept of co-generation. Combined heat and power distributed generation. **06 Hours**

UNIT 2:

Diesel electric plants. Gas turbine plants. Mini, micro, and bio generation. Concept of distributed generation. **06 Hours**

UNIT 3:

(a) **Hydro Power Generation:** Selection of site. Classification of hydro-electric plants. General arrangement and operation. Hydroelectric plant power station structure and control. **5 Hours**

(b) **Thermal Power Generation:** Introduction. Main parts of a thermal power plant. Working. Plant layout. **3 Hours**

UNIT 4:

Nuclear Power Station: Introduction. Pros and cons of nuclear power generation. Selection of site, cost, components of reactors. Description of fuel sources. Safety of nuclear power reactor. **6 Hours**

PART – B**UNIT 5 and 6:**

(a) **Economics Aspects:** Introduction. Terms commonly used in system operation. Diversity factor, load factor, plant capacity factor, plant use factor, plant utilization factor and loss factor, load duration curve. Cost of generating station, factors influencing the rate of tariff designing, tariff, types of tariff. Power factor improvement.

(b) **Substations:** Introduction, types, Bus bar arrangement schemes, Location of substation equipment. Reactors and capacitors. Interconnection of power stations. **14 Hours**

UNIT 7 and 8 :

Grounding Systems: Introduction, grounding systems. Neutral grounding. Ungrounded system. Resonant grounding. Solid grounding, reactance grounding, resistance grounding. Earthing transformer. Neutral grounding transformer. **12 Hours**

Text Books

- Power System Engineering**, A. Chakrabarti, M. L. Soni, and P.V. Gupta, Dhanpat Rai and Co., New Delhi.
- Electric Power Generation, Transmission and Distribution**, S. N. Singh, PHI, 2nd Edition, 2009.

References

- Elements of Electrical Power System Design**, M. V. Deshpande, PHI, 2010

10ESL37 ANALOG ELECTRONICS LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10EEL37	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

10ESL38 LOGIC DESIGN LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10EEL38	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

IV

**SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING**

Subject Code	Title	Teaching Dept.	Teaching hours/week		Examination			
			Theory	Practical	Duration in hours	Marks		
						I. A	Theory/ Practical	Total Marks
10MAT 41	Engineering Mathematics - IV	Mat	04	-	03	25	100	125
10ES42	Microcontrollers	@	04	-	03	25	100	125
10ES43	Control Systems	@	04	-	03	25	100	125
10EE44	Field Theory	E&EE	04	-	03	25	100	125
10EE45	Power Electronics	E&EE	04	-	03	25	100	125
10EE46	Transformers and Induction Machines	E&EE	04	-	03	25	100	125
10ESL47	Microcontrollers Lab	@	-	03	03	25	50	75
10EEL48	Power Electronics Lab	E&EE	-	03	03	25	50	75
		Total	24	06	24	200	700	900

Note : @ indicates concerned discipline. ES (for theory) & ESL (for Lab) in the subject code indicates that the subject is common to Electrical and Electronics stream consisting of EE/EC/IT/TC/ML/BM branches of engineering. EE indicates, subjects specific to E & EE branch only.

10MAT41 ENGINEERING MATHEMATICS – IV

Subject Code	:	10MAT41	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES 42 MICROCONTROLLERS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES42	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10ES43 CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES43	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

Modeling of Systems: Introduction to Control Systems, Types of control systems, Effect of feedback systems, Differential equations of physical systems – Mechanical systems- Friction, Translational systems (Mechanical accelerometer, Levered systems excluded), Rotational systems, Gear trains. Electrical systems, Analogous systems. **6 Hours**

UNIT 2:

Block diagrams and signal flow graphs: Transfer functions, Block diagrams, Signal Flow graphs (State variable formulation excluded). **7 Hours**

UNIT 3:

Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. **7Hours**

UNIT 4:

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz stability criterion, Relative stability analysis; Special cases of RH criterion. **6 Hours**

PART – B

UNIT 5:

Root-Locus Techniques: Introduction, basic properties of root loci, Construction of root loci. **6 Hours**

UNIT 6:

Stability analysis in frequency domain: Introduction, Mathematical preliminaries, Nyquist Stability criterion, (Inverse polar plots excluded), Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded). **7Hours**

UNIT 7:

Frequency domain analysis: Correlation between time and frequency response, Bode plots, All pass and minimum phase systems, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. **7 Hours**

UNIT 8:

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations. **6 Hours**

TEXT BOOK :

1. **Control Systems Engineering**, I. J. Nagarath and M.Gopal, New Age International (P) Limited, 4th Edition – 2005

2 **Modern Control Engineering**, K. Ogata, PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. **Control Systems Engineering**, Norman S Nise, Wiley Student Edition, 5th Edition, 2009
2. **Automatic Control Systems**, Benjamin C. Kuo and Farid Golnaaghi, Wiley Student Edition, 8th Edition, 2009
3. **Feedback and Control Systems**, Joseph J Distefano III and other, Schaum's Outlines, TMH, 2nd Edition, 2007
4. **Control Systems**, Ananda Kumar, PHI, 2009.

10EE44 FIELD THEORY

Subject Code	:	10EE44	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT -1**

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. **03 Hours**

b. Electric flux density, Gauss' law and divergence: Electric flux density, Gauss' law, Divergence, Maxwell's First equation (Electrostatics), vector operator and divergence theorem **04 Hours**

UNIT- 2

a. Energy and potential: Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field **04 Hours**

b. Conductors, dielectrics and capacitance: Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples. **03 Hours**

UNIT- 3

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations. **06 Hours**

UNIT -4

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials. **06 Hours**

PART – B**UNIT- 5**

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit. **03 Hours**

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance. **04 Hours**

UNIT-6

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials. **06 Hours**

UNIT- 7

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors, skin effect.

07HOURS

UNIT- 8

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions. **06 Hours**

TEXT BOOK:

1. **Engineering Electromagnetics**, William H Hayt Jr. and John A Buck, Tata McGraw-Hill, 7th edition, 2009.
2. **Principles of Electromagnetics**, Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2009.

REFERENCE BOOKS:

1. **Electromagnetics with Applications**, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999.
2. **Electromagnetism-Theory and Applications**, Ashutosh Pramanik, PHI, 2nd edition, Reprint 2009.
3. **Field and Wave Electromagnetics**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

10EE45 POWER ELECTRONICS

Subject Code	:	10EE45	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT 1:****Power Semiconductor Devices:**

Introduction to semiconductors, Power Electronics, Power semiconductor devices, Control Characteristics. Types of power electronic converters and industrial applications-Drives, Electrolysis, Heating, Welding, Static Compensators, SMPS, HVDC power transmission, Thyristorized tap changers and Circuit breakers.

7 hours

UNIT 2:

Power Transistors: Power BJT's – switching characteristics, switching limits, base drive control. Power MOSFET's and IGBT's –characteristics, gate drive, di/dt and dv/dt limitations. Isolation of gate and base drives. Simple design of gate and base drives.

6 Hours

UNIT 3:**Thyristors**

Introduction, Two Transistor Model, characteristics-static and dynamic. di/dt and dv/dt protection. Ratings of thyristors. Thyristor types. Series and parallel operation of Thyristors. Thyristor firing circuits. Design of firing circuits using UJT, R, R-C circuits. Analysis of firing circuits using operational amplifiers and digital IC's.

7 Hours

UNIT 4:

Commutation Techniques: Introduction. Natural Commutation. Forced commutation- self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.

6 Hours

PART – B**UNIT 5:**

Controlled Rectifiers: Introduction. Principle of phase controlled converter operation. Single- phase semi-converters. Full converters. Three-phase half-wave converters. Three-phase full-wave converters. **7 Hours**

UNIT 6:

Choppers: Introduction. Principle of step-down and step-up chopper with R-L load. Performance parameters. Chopper classification. Analysis of impulse commutated thyristor chopper (only qualitative analysis) **6 Hours**

UNIT 7:

Inverters: Introduction. Principle of operation. Performance parameters. Single-phase bridge inverters. Three-phase inverters. Voltage control of single-phase inverters – single pulse width, multiple pulse width, and sinusoidal pulse width modulation. Current source inverters. **7 Hours**

UNIT 8:

(a) **AC Voltage Controllers:** Introduction. Principle of ON-OFF and phase control. Single-phase, bi-directional controllers with resistive and R-L loads.
 (b) **Electromagnetic Compatibility:** Introduction, effect of power electronic converters and remedial measures.

6 Hours**Text Book:**

1. **Power Electronics**, M.H.Rashid, , Pearson, 3rd Edition, 2006.
2. **Power Electronics**, M.D. Singh and Khanchandani K.B., T.M.H., 2nd Edition,2001

References

1. **Power Electronics Essentials and Applications**,L.Umanand, Wiley India Pvt Ltd,Reprint,2010
2. **Thyristorised Power Controllers**, G.K. Dubey, S.R. Doradla, A. Joshi and R.M.K. Sinha, New Age International Publishers.
3. **Power Electronics – Converters, Applications and Design**, Ned Mohan, Tore M. Undeland, and William P. Robins, Third Edition, John Wiley and Sons,2008.
4. **Power Electronics: A Simplified Approach**, R.S. Ananda Murthy and V. Nattarasu, pearson/Sanguine Technical Publishers.

10EE46 TRANSFORMERS AND INDUCTION MACHINES

Subject Code	:	10EE46	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A**UNIT 1:**

Basic Concepts: Principle of operation of transformer, Constructional details of shell type and core type single-phase and three-phase transformers. EMF equation, operation of practical power transformer under

no load and on load (with phasor diagrams). Concept of ideal transformers, current inrush in transformers.

6 Hours

UNIT 2:

Single-phase Transformers: Equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and Short circuit tests, calculation of parameters of equivalent circuit. Regulation, predetermination of efficiency and regulation. Polarity test, Sumpner's test.

6 Hours

UNIT 3:

Parallel operation - need, conditions to be satisfied for parallel operation. Load sharing in case of similar and dissimilar transformers. Auto-transformers, copper economy. Brief discussion on constant voltage transformer, constant current transformer.

6 Hours

UNIT 4:

Three-phase Transformers: Introduction, choice between single unit three-phase transformer and bank of single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and vee/vee, choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, phase shift between primary and secondary and vector groups. Conditions for parallel operation of three-phase transformers, load sharing. Equivalent circuit of three-phase transformer.

8 Hours

PART – B

UNIT 5:

Basic Concepts of three phase Induction Machines: Concept of rotating magnetic field. Principle of operation, construction, classification and types - single-phase, three-phase, squirrel-cage, slip-ring. Slip, torque, torque-slip characteristic covering motoring, generating and braking regions of operation. Maximum torque.

7 Hours

UNIT 6:

Three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load. equivalent circuit Losses, efficiency, No-load and blocked rotor tests. Circle diagram and performance evaluation of the motor. Cogging and crawling.

6Hours

UNIT 7:

High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction generator – externally excited and self excited. Importance of induction generators in windmills.

6 Hours

UNIT 8:

(a) Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line (DOL), Star-Delta and autotransformer starting. Rotor resistance starting. Soft(electronic) starters. Speed control - voltage, frequency, and rotor resistance.

4 Hours

(b) Single-phase Induction Motor: Double revolving field theory and principle of operation. Types of single-phase induction motors: split-phase, capacitor start, shaded pole motors. Applications. **3 Hours**

Text Books

1. **Electric Machines**, I. J. Nagrath and D. P. Kothari, T.M.H, 4th Edition, 2010.
2. **Electric Machines**, Mulukuntla S. Sarma, Mukesh K. Pathak, Cengage Learning, First edition, 2009.

References

1. **Performance and Design of A.C. Machines**, M. G. Say, C.B.S. Publishers, 3rd Edition, 2002.
2. **Theory of Alternating Current Machines**, Alexander Langsdorf, T.M.H, 2nd edition, 2001..
3. **Electrical Machines and Transformers**, Kosow, Pearson, 2nd edition, 2007.
4. **Transformers**, BHEL, TMH, 2nd Edition, Eight reprint 2008.

10ESL47 MICROCONTROLLERS LAB (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10EEL47	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

10EEL48 POWER ELECTRONICS LAB

Subject Code	:	10EEL48	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Static characteristics of SCR.
2. Static characteristics of MOSFET and IGBT.
3. SCR turn-on circuit using synchronized UJT relaxation oscillator.
4. SCR Digital triggering circuit for a single-phase controlled rectifier and A.C. voltage controller.
5. Single-phase controlled full-wave rectifier with R and $R-L$ loads.
6. A.C. voltage controller using TRIAC and DIAC combination connected to R and $R-L$ loads.
7. Speed control of a separately excited D.C. motor using an IGBT or MOSFET chopper.
8. Speed control of D.C. motor using single semi converter
9. Speed control of a stepper motor.
10. Speed control of universal motor using A.C. voltage controller.
11. MOSFET OR IGBT based single-phase full-bridge inverter connected to R load.
12. Study of commutation using LC circuits and auxiliary circuits.

**FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April
2010**

V

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
01	10AL51	Management and Entrepreneurship	@	4	-	3	25	100	125
02	10EE52	Signals and Systems	E&EE	4	-	3	25	100	125
03	10EE53	Transmission and Distribution	E&EE	4	-	3	25	100	125
04	10EE54	D.C. Machines and Synchronous Machines	E&EE	4	-	3	25	100	125
05	10EE55	Modern Control theory	E&EE	4	-	3	25	100	125
06	10EE56	Linear IC's and Applications	E&EE	4	-	3	25	100	125
07	10EEL57	Measurements and Circuit Simulation Laboratory	E&EE	-	3	3	25	50	75
08	10EEL58	Transformers and Induction Machines Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

@- Any Engineering department or department of Business study.

10AL51 Management and Entrepreneurship

Subject Code	:	10AL51	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

10EE52 SIGNALS AND SYSTEMS

Subject Code	:	10EE52	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION-Definitions of signals and a system, classification of signals, basic operations on signals, elementary signals viewed as interconnections of operations, properties of systems. **10 Hours**

UNIT – 2 and 3

TIME – DOMAIN REPRESENTATIONS FOR LTI SYSTEMS-Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. **10 Hours**

UNIT - 4

FOURIER REPRESENTATION OF PERIODIC SIGNALS-Introduction, Fourier representation of continuous-time periodic signals (FS), properties of continuous-time Fourier series (excluding derivation of defining equations for CTFS), Fourier representation of discrete-time periodic signals, properties of discrete-time Fourier series (DTFS). **6 Hours**

PART - B**UNIT - 5**

THE CONTINUOUS-TIME FOURIER TRANSFORM-Representation of a periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform. Application; frequency response of LTI systems, Solutions of differential equations. **7 Hours**

UNIT - 6

THE DISCRETE-TIME FOURIER TRANSFORM-Representations of periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT. Application; frequency response of LTI systems, Solutions of differential equations. **7 Hours**

UNIT –7 and 8

Z- TRANSFORMS-Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. **12 Hours**

TEXT BOOKS:

1. **Signals and Systems**- Simon Haykin and Barry Van Veen, John Wiley & Sons, 2nd Edition 2008.
2. **Fundamentals of Signals and Systems** - Michel J Roberts, TMH, 2nd Edition, 2010.

REFERENCE BOOKS:

1. **Signals and Systems**, Alan V Oppenheim, Alan S. Willsky and S. Hamid Nawab, PHI, 2nd edition, 2009.
2. **Signals and Systems**, H P Hsu and others, Schaums Outline Series, TMH, 2nd Edition, 2008.

10EE53 TRANSMISSION AND DISTRIBUTION

Subject Code	:	10EE53	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

TYPICAL TRANSMISSION & DISTRIBUTION SYSTEMS SCHEME-General layout of power system, Standard voltages for transmission, advantages of high voltage transmission. Transmission line efficiency and line drop. Feeders, distributors & service mains. **5 Hours**

UNIT - 2

OVERHEAD TRANSMISSION LINES- Types of supporting structures and line conductors used. Sag calculation- supports at same level and at different levels. Effect of wind and ice, Sag at erection, Stringing chart and sag templates. Line vibrators. **5 Hours**

UNIT – 3

INSULATORS- Introduction, materials used, types, potential distribution over a string of suspension insulators. String efficiency & methods of increasing strings efficiency, grading rings and arcing horns. Testing of insulators. **6 Hours**

UNIT - 4

(A) **CORONA**- Phenomena, disruptive and visual critical voltages, corona power loss. Advantages and disadvantages of corona. **4 Hours**

(B) **UNDERGROUND CABLES**- Types, material used, insulation resistance, thermal rating of cables, charging current, grading of cables, capacitance grading & inter sheath grading, testing of cables. **6 Hours**

Part - B**UNIT – 5 and 6**

Line parameters: calculation of inductance of single phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite conductor lines. Capacitance- of single-phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite conductor lines. **12 Hours**

UNIT - 7

Performance of power transmission lines- Short transmission lines, medium transmission lines- nominal T, end condenser and π models, long transmission lines, ABCD constants of transmission lines, Ferranti effect, line regulation. **8 Hours**

UNIT - 8

Distribution- Requirements of power distribution, radial & ring main systems, ac and dc distribution: calculation for concentrated loads and uniform loading. **6 Hours**

TEXT BOOKS:

1. **A Course in Electrical Power**- Soni Gupta & Bhatnaagar, Dhanpat Rai & Sons.
2. **Electrical Power Systems**- C. L. Wadhwa, New Age International, 5th Edition, 2009.

REFERENCE BOOKS:

1. **Elements of Power System Analysis**- W.D. Stevenson, TMH, 4th Edition
2. **Electric power generation Transmission & Distribution**- S. M. Singh, PHI, 2nd Edition, 2009.
3. **Electrical Power**- Dr. S. L. Uppal, Khanna Publications

10EE54 D.C. MACHINES AND SYNCHRONOUS MACHINES

Subject Code	:	10EE54	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

DC GENERATOR-Review of basics of DC machines, classification of DC generator, types of armature winding, EMF equation, no-load characteristic, armature reaction, load characteristics. Commutation, types of Commutation, commutation difficulties, interpoles, compensating winding and equalizer rings (only qualitative treatment). **8 Hours**

UNIT - 2

DC Motors- (a) Classification, Back EMF and its significance, Torque equation, Characteristics of shunt, series & compound motors, speed control of shunt, series and compound motors. Application of motors. DC motor starters

(b) Special DC motors- permanent magnet motors, brushless DC motors. Applications. **8 Hours**

UNIT – 3 and 4

LOSSES AND EFFICIENCY- Losses in DC machines, power flow diagram, efficiency, condition for maximum efficiency.

TESTING OF DC MACHINES- Direct & indirect methods of testing of DC machines- Brake test, Swinburn's test, Hopkinson's test, Retardation test, Field's test, merits and demerits of tests.

10 Hours

PART - B**UNIT - 5**

SYNCHRONOUS MACHINES- Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution and chording of winding, harmonics-causes, reduction and elimination. Armature reaction, synchronous reactance, leakage reactance, phasor diagram of non salient type alternator. **5 Hours**

UNIT - 6

VOLTAGE REGULATION: Voltage regulation by EMF, MMF, ZPF & ASA method. Short circuit ratio and its importance. Two reaction theory-direct and quadrature axis reactances, phasor diagram. Slip test and regulation. **8 Hours**

UNIT - 7

Synchronizing to infinite bus bars, parallel operation of alternators. Operating characteristics, power angle characteristics excluding armature resistance, operation for fixed input and variable excitation, power flow equations including armature resistance, capability curves of synchronous generators. **6 Hours**

UNIT - 8

SYNCHRONOUS MOTOR: Principle of operation, phasor diagrams, torque and torque angle, Blondal diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors. **7 Hours**

TEXT BOOKS:

1. **Electrical machinery**, P.S Bhimbra, Khanna Publishers
2. **Electrical machines**, DP Kothari, I.J.Nagarath, TMH, 4th edition, 2010.
3. **Electric Machines**, Mulukuntla S.Sarma, Mukesh K.Pathak, Cengage Learning, First edition, 2009.

REFERENCE BOOKS:

1. **Performance & Design of Alternating Current machines**, M. G. Say, CBS publishers, 3rd Edition, 2002.
2. **The Performance & Design of DC machines** A.E Clayton & N.N.Hancock CBS Publication, 3rd Edition, 2004.
3. **Electrical Machines**, Ashfaq Hussain, Dhanpat Rai Publications.

10EE55 MODERN CONTROL THEORY

Subject Code	:	10EE55	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT – 1 and 2

STATE VARIABLE ANALYSIS AND DESIGN: Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. **10 Hours**

UNIT - 3

Derivation of transfer function from state model, diagonalization, Eigen values, Eigen vectors, generalized Eigen vectors. **6 Hours**

UNIT - 4

Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same. **10 Hours**

PART - B

UNIT - 5

POLE PLACEMENT TECHNIQUES: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P, PI, PID. **10 Hours**

UNIT - 6

Non-linear systems: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi variable non-linearity. **3 Hours**

UNIT - 7

Phase plane method, singular points, stability of nonlinear system, limit cycles, construction of phase trajectories. **7 Hours**

UNIT - 8

Liapunov stability criteria, Liapunov functions, direct method of Liapunov & the linear system, Hurwitz criterion & Liapunov's direct method, construction of Liapunov functions for nonlinear system by Krasvskii's method. **6 Hours**

TEXT BOOKS:

1. **Digital control & state variable methods**, M. Gopal , 3rd Edition, TMH ,2008
2. **Control system Engineering**, I. J. Nagarath & M. Gopal, New Age International (P)Ltd, 3rd edition.

REFERENCE BOOKS:

1. **State Space Analysis of Control Systems**, Katsuhiko Ogata -PHI
2. **Automatic Control Systems**, Benjamin C. Kuo & Farid Golnaraghi, 8th edition, John Wiley & Sons 2009.
3. **Modern Control Engineering**, Katsuhiko Ogata, PHI,5th Edition, 2010
4. **Modern Control Engineering**, D. Roy Choudary,PHI, 4th Reprint,2009.
5. **Modern control systems**, Dorf & Bishop- Pearson education, 11th Edition 2008

10EE56 LINEAR IC'S AND APPLICATIONS

Subject Code	:	10EE56	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OP-AMPS AS AC AMPLIFIER: Capacitor coupled voltage follower, high Z_{in} capacitor coupled voltage follower, capacitor coupled non-inverting amplifier, high Z_{in} capacitor coupled non-inverting amplifier, capacitor coupled inverting amplifier, setting upper cut off frequency, capacitor coupled difference amplifier, and use of single polarity supply. **6 Hours**

UNIT 2

OP-AMPS FREQUENCY RESPONSE AND COMPENSATION: Op amp circuits stability, frequency and phase response, frequency compensating methods ,manufacturer's recommended compensation, op-amp circuit band width, slew rate effects, stray capacitance effects, load capacitance effects, Z_{in} mode compensation, circuit stability precautions. **7 Hours**

UNIT - 3

SIGNAL PROCESSING CIRCUITS: Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample & hold circuit. DAC and ADC (Flash and successive approximations) **7 Hours**

UNIT - 4

OPAMPS AND NONLINEAR CIRCUITS: Op-amps in switching circuits, zero crossing detectors, inverting Schmitt trigger circuits, non-inverting Schmitt circuits, astable multivibrator, and monostable multivibrator. **6 Hours**

PART - B

UNIT - 5

SIGNAL GENERATOR: Triangular/rectangular wave generator, waveform generator design, phase shift oscillator, oscillator amplitude stabilization, Wein bridge oscillator, signal generators, output controllers **7 Hours**

UNIT - 6

ACTIVE FILTERS: First and second order high pass and low pass filters, band pass filter, band stop filter. **7 Hours**

UNIT - 7

SPECIALIZED IC APPLICATIONS: Universal active filter, switched capacitor filter, phase locked loops, power amplifiers. **6 Hours**

UNIT - 8

DC VOLTAGE REGULATORS: Voltage regulators basics, voltage follower regulator, adjustable output regulator, precision voltage regulators, and integrated circuit voltage regulators. **6 Hours**

TEXT BOOKS:

1. **Operational amplifiers and linear IC's**, David A Bell, Oxford University Press, 2010.
2. **Operational amplifiers and linear IC's**, Ramakanth A Gayakwad, PHI, 4th edition, 2009.
3. **Linear integrated circuits**, S.P. Bali, TMH, 2009.

REFERENCE BOOKS:

1. **Op Amps and Linear Integrated Circuits-Concepts and Applications**, James M. Fiore, Cengage Learning, 2009.
2. **Op Amps, Design, Applications and Trouble Shooting**, Elsevier, 2nd Edition.
3. **Operational amplifiers and linear IC's**, Stanley William D, - 4th edition, Pearson Education.
4. **Linear Integrated Circuits- Analysis, Design and Applications**, B. Somanathan Nair, Wiley India, First, Edition, 2009.

10EEL57 MEASUREMENTS AND CIRCUIT SIMULATION LABORATORY

Subject Code	:	10EEL57	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurement of cable insulation and earth resistance using Meggar
3. Measurement of inductance using Maxwell Inductance-Capacitance bridge & determination of Q-factor
4. Measurement of capacitance using De-Sauty's bridge & determination of dissipation factor.
5. Measurement of active and reactive power in balanced 3-phase circuit using two-watt meter method.
6. Adjustment & calibration of 1-phase energy meter
7. Determination of ratio & phase angle error in CT.
8. a) Inverting, non-inverting & scale changing of signals using op -amps
b) RC phase shift oscillator using op amps (Both using simulation package)
9. RC coupled amplifier-frequency response for variation of bias & coupling using simulation package
10. Rectifier circuits-Bridge rectifier, diode clipping & clamping circuits using simulation package.
11. Schmitt –trigger- inverting and non-inverting.
- 12 Signal generator- triangular, saw tooth and rectangular wave generation

Note: All experiments, except 5,6 and 7, are to be carried out by using components and verify the result by using a simulation package.

10EEL58 TRANSFORMERS AND INDUCTION MACHINES LABORATORY

Subject Code	:	10EEL58	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. (a) Predetermination of efficiency and regulation by Open Circuit and Short circuit tests on single - phase transformer.
(b) Calculation of parameters of equivalent circuit from the readings of the tests and determination of efficiency and regulation from the equivalent circuit to correlate results obtained earlier.
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3. Parallel operation of two dissimilar (different kVA) single-phase transformers and determination of load sharing and analytical verification given the Open Circuit and Short circuit tests details.
4. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5. Scott connection with balanced and unbalanced resistive loads.
6. Load test on 3-phase induction motor- and plot of Torque versus speed, output hp versus efficiency, power factor and slip.
7. Predetermination of performance of 3-phase induction Motor from the Circle diagram.
8. (a) Determination of parameters of the equivalent circuit of a 3-phase Induction Motor by conducting NO load and Blocked rotor tests.
(b) Determination of performance quantities of the induction motor from the equivalent circuit to correlate the results obtained from the load test or circle diagram.

9. Speed control of 3-phase induction motor by varying rotor resistance.
10. Load test on- induction generator.
11. Load test on single- phase induction motor.

FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010

VI SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching		Examination			
				Hrs / Week		Duration (Hrs)	Marks		
				Theory	Practical		IA	Theory / Practical	Total
1	10EE61	Power System Analysis and Stability	E&EE	4	-	3	25	100	125
2	10EE62	Switchgear & Protection	E&EE	4	-	3	25	100	125
3	10EE63	Electrical Machine Design	E&EE	4	-	3	25	100	125
4	10EE64	Digital Signal Processing	E&EE	4	-	3	25	100	125
5	10EE65	CAED (Computer Aided Electrical Drawing)	E&EE	1	3	3	25	100	125
6	10EE66X	Elective-I (Group A)	E&EE	4	-	3	25	100	125
7	10EEL67	D.C. Machines and Synchronous Machines Laboratory	E&EE	-	3	3	25	50	75
8	10EEL68	Control Systems Laboratory	E&EE	-	3	3	25	50	75
Total				21	09	24	200	700	900

Elective-I (Group A)

10EE661- Operation Research

10EE662 - Advanced Power Electronics

10EE663 – Fuzzy Logic

10EE664 - Object Oriented Programming using C++

10EE665 - Embedded Systems

10EE666 – Electrical Engineering Materials.

10EE61 POWER SYSTEM ANALYSIS AND STABILITY

Subject Code	:	10EE61	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

REPRESENTATION OF POWER SYSTEM COMPONENTS: Circuit models of Transmission line, Synchronous machines, Transformers and load. Single line diagram, impedance and reactance diagrams. Per unit system, per unit impedance diagram of power system. **8 Hours**

UNIT - 2

SYMMETRICAL 3 - PHASE FAULTS: Analysis of Synchronous machines and Power system. Transients on a transmission line, Short-Circuit currents and the reactance of synchronous machines with and without load **6 Hours**

UNIT - 3 & 4

SYMMETRICAL COMPONENTS: Introduction, analysis of unbalanced load against balanced Three-phase supply, neutral shift. Resolution of unbalanced phasors into their symmetrical components, Phase shift of symmetrical components in star-delta transformer bank, Power in terms of symmetrical components, Analysis of balanced and unbalanced loads against unbalanced 3 phase supply, Sequence impedances and networks of power system elements (alternator, transformer and transmission line) Sequence networks of power systems. Measurement of sequence impedance of synchronous generator. **12 Hours**

Part - B

UNIT - 5 & 6

UNSYMMETRICAL FAULTS: L-G, L-L, L-L-G faults on an unbalanced alternator with and without fault impedance. Unsymmetrical faults on a power system with and without fault impedance. Open conductor faults in power system. **14 Hours**

UNIT - 7

STABILITY STUDIES: Introduction, Steady state and transient stability. Rotor dynamics and the swing equation. Equal area criterion for transient stability evaluation and its applications. **8 Hours**

UNIT - 8

UNBALANCED OPERATION OF THREE PHASE INDUCTION MOTORS: Analysis of three phase induction motor with one line open., Analysis of three phase induction motor with unbalanced voltage. **4 Hours**

TEXT BOOKS:

1. **Elements of Power System Analysis**, W.D.Stevenson, TMH, 4th Edition
2. **Modern Power System Analysis**, I. J. Nagrath and D.P.Kothari- TMH, 3rd Edition, 2003.
3. **Symmetrical Components and Short Circuit Studies**, Dr.P.N.Reddy, Khanna Publishers

REFERENCE BOOKS:

1. **Power System Analysis**, Hadi Sadat, TMH, 2nd Edition.
2. **Power system Analysis**, R.Bergen, and Vijay Vittal, Pearson publications, 2nd edition, 2006.
3. **Computer Aided Power system analysis**, G.L., Kusic, PHI. Indian Edition, 2010 .
4. **Power System Analysis**, W.D.Stevenson & Grainger, TMH, First Edition, 2003.

10EE62 SWITCHGEAR & PROTECTION

Subject Code	:	10EE62	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

SWITCHES AND FUSES: Introduction, energy management of power system, definition of switchgear, switches - isolating, load breaking and earthing. Introduction to fuse, fuse law, cut -off characteristics,; Time current characteristics, fuse material, HRC fuse, liquid fuse, Application of fuse

4 Hours

UNIT - 2

PRINCIPLES OF CIRCUIT BREAKERS: Introduction, requirement of a circuit breakers, difference between an isolator and circuit breaker, basic principle of operation of a circuit breaker, phenomena of arc, properties of arc, initiation and maintenance of arc, arc interruption theories - slepian's theory and energy balance theory, Restriking voltage, recovery voltage, Rate of rise of Restriking voltage, DC circuit breaking, AC circuit breaking, current chopping, capacitance switching, resistance switching, Rating of Circuit breakers.

10 Hours

UNIT - 3 & 4

CIRCUITS BREAKERS: Air Circuit breakers – Air break and Air blast Circuit breakers, oil Circuit breakers - Single break, double break, minimum OCB, SF₆ breaker - Preparation of SF₆ gas, Puffer and non Puffer type of SF₆ breakers. Vacuum circuit breakers - principle of operation and constructional details. Advantages and disadvantages of different types of Circuit breakers, Testing of Circuit breakers, Unit testing, synthetic testing, substitution test, compensation test and capacitance test.

LIGHTNING ARRESTERS: Causes of over voltages – internal and external, lightning, working principle of different types of lightning arresters. Shield wires.

12 Hours

PART - B

UNIT - 5

PROTECTIVE RELAYING: Requirement of Protective Relaying, Zones of protection, primary and backup protection, Essential qualities of Protective Relaying, Classification of Protective Relays

4 Hours

UNIT - 6

INDUCTION TYPE RELAY: Non-directional and directional over current relays, IDMT and Directional characteristics. Differential relay – Principle of operation, percentage differential relay, bias characteristics, distance relay – Three stepped distance protection, Impedance relay, Reactance relay, Mho relay, Buchholz relay, Negative Sequence relay, Microprocessor based over current relay – block diagram approach.

10 Hours

UNIT - 7 & 8

PROTECTION SCHEMES: Generator Protection - Merz price protection, prime mover faults, stator and rotor faults, protection against abnormal conditions – unbalanced loading, loss of excitation, over speeding. Transformer Protection - Differential protection, differential relay with harmonic restraint, Inter turn faults Induction motor protection - protection against electrical faults such as phase fault, ground fault, and abnormal operating conditions such as single phasing, phase reversal, over load.

12 Hours

TEXT BOOKS: ,

1. **Switchgear & Protection** Sunil S.Rao,,Khanna Publishers,13th Edition,2008.
2. **Power System Protection & Switchgear**, Badriram & Viswa Kharma ,TMH,1st edition, 2001.
3. **Fundamentals of Power System protection**, Y G. Painthankar and S R Bhide,PHI, 2009.

REFERENCE BOOKS:

1. **A Course in Electrical Power**, Soni, Gupta & Bhatnagar, Dhanapatirai.
2. **Power System Protection & Switchgear**, Ravindarnath & Chandra -New age Publications.
3. **Electrical Power**, Dr S. L. Uppal, Khanna Publishers.
4. **Handbook of Switchgears**, BHEL, TMH, 5th reprint, 2008.

10EE63 ELECTRICAL MACHINE DESIGN

Subject Code	:	10EE63	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

PRINCIPLES OF ELECTRICAL MACHINE DESIGN: Introduction, considerations for the design of electrical machines, limitations. Different types of materials and insulators used in electrical machines.

4 Hours**UNIT - 2**

DESIGN OF DC MACHINES: Output equation, choice of specific loadings and choice of number of poles, design of Main dimensions of the DC machines, Design of armature slot dimensions, commutator and brushes, magnetic circuit - estimation of ampere turns, design of yoke and poles- main and inter poles, field windings – shunt, series and inter poles.

10 Hours**UNIT - 3 & 4**

DESIGN OF TRANSFORMERS (Single phase and three phase): Output equation for single phase and three phase transformers, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and conductor cross sectional area of Primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular)

12 Hours**PART - B****UNIT - 5 & 6**

DESIGN OF INDUCTION MOTORS: Output equation, Choice of specific loadings, main dimensions of three phase induction motor, Stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of Rotor bars and end ring, design of Slip ring induction motor, estimation of No load current and leakage reactance, and circle diagram.

14 Hours**UNIT - 7 & 8**

DESIGN OF SYNCHRONOUS MACHINES: Output equation, Choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non

salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non-salient pole machine .

12 Hours

TEXT BOOKS:

1. **A Course In Electrical Machine Design**, A.K.Sawhney,Dhanpatt Rai & Sons
2. **Design Of Electrical Machines**, V. N. Mittle, 4th edition

REFERENCE BOOKS:

1. **Performance And Design Of AC Machines**, M.G.Say,CBS Publishers and Distributors Pvt.Ltd.
2. **Design Data Handbook**, A.Shanmugasundarm, G.Gangadharan,R.Palani,Wiley Eastern Ltd.

10EE64 DIGITAL SIGNAL PROCESSING

Subject Code	: 10EE64	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT - 1 and 2

Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry etc, circular convolution – periodic convolution, use of tabular arrays, circular arrays, stock hams’s method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods.

14 Hours

UNIT – 3 and 4

FAST FOURIER TRANSFORMS ALGORITHMS: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, algorithm, inverse decimation in time and inverse decimation in frequency algorithms, decomposition for a composite number N=9. **12 Hours**

PART - B

UNIT – 5 AND 6

DESIGN OF IIR DIGITAL FILTERS: Introduction, impulse invariant & bilinear transformations, all pole analog filters- Butterworth & chebyshev, design of digital Butterworth & chebyshev, frequency transformations **12 Hours**

UNIT 7

DESIGN OF FIR DIGITAL FILTERS: Introduction, windowing, rectangular, modified rectangular, Hamming, Hanning, blackman window(excluding Kaiser window), frequency sampling techniques. **8 Hours**

UNIT - 8

REALIZATION OF DIGITAL SYSTEMS: Introduction, block diagrams and SFGs, realization of IIR systems- direct form, cascaded, parallel form, ladder structures for equal degree polynomial, realization of FIR systems – direct form, cascade form, linear phase realization. **06 Hours**

TEXT BOOKS:

1. **Digital Signal Processing Principle, Algorithm & application**, Proakis, Pearson,4th education, 2009.

2. **Digital Signal Processing** , Sanjeet. K. Mitra ,TMH,3rd Edition,2009.

REFERENCE BOOKS:

1. **Introduction To Digital Signal Processing**, Johnny R. Johnson, PHI, 2009
2. **Discrete Time Signal Processing** ,Openheim, pearson 2nd Edition 2009
3. **Digital Signal Processing**, S.Salivahanan,A. Vallaraj,C.Gnanapriya,TMH,2nd Edition,2010.
4. **Digital Signal Processing**. Ifeakor Emmanuel- Pearson education,2nd Edition,2006.
5. **Fundamentals of Digital Signal Processing**,Ludeman,John Wiley, 3rd Edition,2008

10EE65 CAED (COMPUTER AIDED ELECTRICAL DRAWING)

Subject Code	:	10EE65	IA Marks	:	25
No. of Lecture and Practice Hrs./ Week	:	01Hour Lecture + 03 Hours Practical	Exam Hours	:	03
Total No. of Lecture and Practice Hrs.	:	52	Exam Marks	:	100

PART - A

1. Winding Diagrams

- (a) Developed winding diagrams of D.C. machines – Simplex and multiplex double layer Lap and Wave windings.
- (b) Developed winding diagrams of A.C. machines
 - (i) Integral and Fractional slot double layer Lap and Wave windings.
 - (ii) Single layer windings – Un-bifurcated 2 and 3 tier windings, mush windings, Bifurcated 2 and 3 tier windings.

2. Single line diagrams of generating stations and substations.

20 Hours

PART - B

3. Electrical machine assembly drawing using designs data or sketches or both.

- (a) Transformers - sectional views of single and three phase core and shell type transformers.
- (b) D.C. machine - sectional views of yoke, field system, armature and commutator dealt Separately.
- (c) Alternator – sectional views of stator and rotor dealt separately.

32 Hours

TEXT BOOKS:

1. **Performance & Design of Alternating Current machines**, M. G. Say, CBS publishers,3rd Edition,2002.
2. **The Performance & Design of DC machines** A.E Clayton & N.N.Hancock CBS Publication,3rd Edition,2004.

REFERENCE BOOKS:

1. **Manuals of Auto - CAD**

Elective-I (Group A)**10EE666 ELECTRICAL ENGINEERING MATERIALS**

Subject Code	:	10EE666	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

CONDUCTING MATERIALS: Review of metallic conduction on the basis of free electron theory. Fermi-Dirac distribution – variation of conductivity with temperature and composition, materials for electric resistors- general electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder. **6 Hours**

UNIT - 2

SEMICONDUCTORS: Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Magnetic materials: Classification of magnetic materials- origin of permanent magnetic dipoles, ferromagnetism, hard and soft magnetic materials, magneto materials used in electrical machines, instruments and relays. **10 Hours**

UNIT - 3 & 4

DIELECTRICS: Dielectric, polarization under static fields- electronic ionic and dipolar polarizations, behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials. Insulating materials, complex dielectric constant, dipolar relaxation and dielectric loss.

INSULATING MATERIALS: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF₆ and nitrogen) and ageing of insulators. **10 Hours**

PART - B**UNIT - 5**

MATERIALS FOR SPECIAL APPLICATIONS: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts. **6 Hours**

UNIT - 6

MODERN TECHNIQUES FOR MATERIALS STUDIES: Optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic resonance, nuclear magnetic resonance, electron spin resonance and ferromagnetic resonance. **6 Hours**

UNIT - 7

Introduction Properties and Application of Piezoelectric materials, Electrostrictive materials, Ferromagnetic materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels. **6 Hours**

UNIT - 8

Ceramics: properties, application to conductors, insulators & capacitors

Plastics: Thermoplastics, rubber, thermostats, properties.

8Hours**TEXT BOOKS:**

1. **An Introduction to Electrical Engineering-** Indulkar C.S. & Thiruvengadam. S, Chand publishers.

2. **Materials Science for Electrical and Electronic Engineers**, Ian P. Jones, Oxford University Press, Indian Edition, 2007.

3. **Electrical Engineering Materials**, Kapoor P L., Khanna Publications.

4. **Renewable Energy Sources and Emerging Technologies**, D.P. Kothari, K.C. Singal, Rakesh Ranjan. PHI, 2008.

REFERENCES:

1. **Electrical Properties of Materials**, L.Solymar, D.Walsh, 8th Indian Edition- Oxford University Press Seventh Edition.

2. **MEMS and MOEMS Technology and Applications**, P.Rai-Choudhury (Editor), PHI, 2009 .

3. **Introduction to Electronic Properties and Materials**, David Jiles, CRC Press, 2nd Edition.

10EEL 67 DC MACHINES AND SYNCHRONOUS MACHINES LABORATORY

Subject Code	: 10EEL67	IA Marks	: 25
No. of Practical Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Practical Hrs.	: 42	Exam Marks	: 50

- Load characteristics of a D.C. shunt and compound generator - i) Short shunt-Cumulative and Differential (ii) Long shunt-Cumulative and Differential.
- Load test on a DC motor- determination of speed-torque and HP-efficiency characteristics.
- Swinburne's Test.
- Hopkinson's Test.
- Field's test on series motors.
- Retardation test- electrical braking method.
- Speed control of DC motor by armature voltage control and flux control.
- Ward Leonard method of speed control of D.C. motor.
- Voltage regulation of an alternator by EMF and MMF method.
- Voltage regulation of an alternator by ZPF method.
- Slip test and determination of regulation.
- Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
- V and Inverted V curves of a synchronous motor.
- Measurement of X_1 , X_2 and X_0 of a Synchronous generator and calculation of currents for an LG, LL or LLG fault.

10EEL68 CONTROL SYSTEMS LABORATORY

Subject Code	: 10EEL68	IA Marks	: 25
No. of Practical Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Practical Hrs.	: 42	Exam Marks	: 50

- Using MATLAB/SCILAB a) Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications

- b) Evaluation of the effect of additional poles and zeroes on time response of second order system
 - c) Evaluation of effect of pole location on stability
 - d) Effect of loop gain of a negative feedback system on stability
2. (a) To design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.
(b) To determine experimentally the transfer function of the lead compensating network.
 3. (a) To design RC lag compensating network for the given specifications., viz., the maximum phase lag and the frequency at which it occurs, and to obtain its frequency response.
(b) To determine experimentally the transfer function of the lag compensating network.
 4. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
 5. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system (using control engineering trainer/process control simulator). Verify the same by simulation.
 6. a) Experiment to draw the speed – torque characteristic of a two - phase A.C. servomotor.
b) Experiment to draw speed torque characteristic of a D.C. servomotor.
 7. To determine experimentally the frequency response of a second -order system and evaluation of frequency domain specifications.
8. Using MATLAB/SCILAB
 - a) Simulate a D. C. position control system and obtain its step response
 - b) To verify the effect of the input wave form, loop gain system type on steady state errors.
 - c) To perform a trade-off study for lead compensation
 - d) To design a PI controller and study its effect on steady state error
 9. Using MATLAB/SCILAB
 - a) To examine the relationships between open-loop frequency response and stability , open loop frequency and closed loop transient response
 - b) To study the effect of addition closed loop poles and zeroes on the closed loop transient response
 10. Using MATLAB/SCILAB
 - a) Effect of open loop and zeroes on root locus contour
 - b) To estimate the effect of open loop gain on the transient response of closed loop system by using Root locus
 - c) Comparative study of Bode, Nyquist and Root locus with respect to Stability.
 11. Experiment to draw to syncro pair characteristics.

FINAL SCHEME OF TEACHING & EXAMINATION and Syllabus - Dated 16th and 17th April 2010**VII****SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE71	Computer Techniques in Power System Analysis	E&EE	4	-	3	25	100	125
2	10EE72	Electrical Power Utilization	E&EE	4	-	3	25	100	125
3	10EE73	High Voltage Engineering	E&EE	4	-	3	25	100	125
4	10EE74	Industrial Drives and Applications	E&EE	4	-	3	25	100	125
5	10EE75X	Elective-II (Group B)	E&EE	4	-	3	25	100	125
6	10EE76X	Elective-III (Group C)	E&EE	4	-	3	25	100	125
7	10EEL77	Relay and High Voltage Laboratory	E&EE	-	3	3	25	50	75
8	10EEL78	Power System Simulation Laboratory	E&EE	-	3	3	25	50	75
Total				24	06	24	200	700	900

Elective-II (Group B)

10EE751 - HVDC Transmission
 10EE752 - Programmable Logic Controllers
 10EE753 - Artificial Neural Network
 10EE754 - Operating System
 10EE755 - Digital System with VHDL
 10EE756 - Testing and Commissioning of Electrical Equipment

Elective-III (Group C)

10EE761 - Power System Planning
 10EE762 - Computer Control of Electrical Drives
 10EE763 - Data Structure
 10EE764 - VLSI Circuits and Design
 10EE765 - Micro & Smart System Technology
 10EE766 - Electromagnetic Compatibility

10EE71 COMPUTER TECHNIQUES IN POWER SYSTEM ANALYSIS

Subject Code	:	10EE71	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

NETWORK TOPOLOGY: Introduction, Elementary graph theory – oriented graph, tree, co-tree, basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence, Tree-branch path, Basic cut-set, Augmented cut-set, Basic loop and Augmented loop, Primitive network – impedance form and admittance form. **6 Hours**

UNIT - 2

NETWORK MATRICES: Introduction, Formation of Y_{BUS} by method of inspection (including transformer off-nominal tap setting) and method of singular transformation ($Y_{BUS} = A^T y A$), Formation of Bus Impedance matrix by step by step building algorithm (without mutual coupling elements). **6 Hours**

UNIT - 3 & 4

LOAD FLOW STUDIES: Introduction, Power flow equations, Classification of buses, Operating constraints, Data for load flow, Gauss-Seidal Method – Algorithm and flow chart for PQ and PV buses (numerical problem for one iteration only), Acceleration of convergence; Newton Raphson's Method – Algorithm and flow chart for NR method in polar coordinates (numerical problem for one iteration only). Algorithm for Fast Decoupled load flow method, Comparison of Load Flow Methods. **14 Hours**

PART - B

UNIT - 5 & 6

ECONOMIC OPERATION OF POWER SYSTEM: Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation scheduling including generator limits and neglecting losses; Iterative techniques; Economic Dispatch including transmission losses – approximate penalty factor, iterative technique for solution of economic dispatch with losses; Derivation of transmission loss formula; Optimal scheduling for Hydrothermal plants – problem formulation, solution procedure and algorithm. **12 Hours**

UNIT - 7 & 8

TRANSIENT STABILITY STUDIES: Numerical solution of Swing Equation – Point-by-point method, Modified Euler's method, Runge-Kutta method, Milne's predictor corrector method. Representation of power system for transient stability studies – load representation, network performance equations. Solution techniques with flow charts. **14 Hours**

TEXT BOOKS:

1. **Computer Methods in Power System Analysis**, Stag, G. W., and EI-Abiad, A. H.- McGraw Hill International Student Edition. 1968
2. **Computer Techniques in Power System Analysis**, Pai, M. A- TMH, 2nd edition, 2006.

REFERENCE BOOKS:

1. **Modern Power System Analysis**, Nagrath, I. J., and Kothari, D. P, TMH,3rd Edition, 2003.
2. **Advanced Power System Analysis and Dynamics**, Singh, L. P, New Age International (P) Ltd, New Delhi, 2001.
3. **Computer Aided Power System Operations and Analysis**- Dhar, R. N, TMH, 1984.
4. **Power System Analysis**, Haadi Sadat, TMH, 2nd Edition, 12th reprint, 2007

10EE72 ELECTRICAL POWER UTILIZATION

Subject Code	:	10EE72	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

HEATING AND WELDING: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building. Electric welding, resistance and arc welding, control devices and welding equipment. **10 Hours**

UNIT - 2

ELECTROLYTIC PROCESS: Fundamental principles, extraction, refining of metals and electroplating. Factors affecting electro deposition process, power supply for electrolytic process. **6 Hours**

UNIT - 3 & 4

ILLUMINATION: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapor, CFL and LED lamps and their working, comparison, Glare and its remedy. **10 Hours**

PART - B**UNIT - 5, 6 & 7**

ELECTRIC TRACTION: Introduction, requirements of an ideal traction,systems of traction, speed time curve, tractive effort,co-efficient of adhesion, selection of traction motors, method of speed control, energy saving by series parallel control, ac traction equipment. AC series motor, characteristics, regenerative braking, linear induction motor and their use. AC traction, diesel electric equipment, trains lighting system, specific energy, factors affecting specific energy consumption. **20 Hours**

UNIT - 8

INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES: Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption. **6 Hours**

TEXT BOOKS:

1. **Utilization Of Electric Energy**,E Openshaw Taylor, 12th Impression,2009,Universities Press.
2. **Modern Electric, Hybrid Electric and Fuel Cell Vehicles**, Mehrdad, Ehsani, Yimin Gao, Sabastien. E. Gay, Ali Emadi- CRC Press.

REFERENCE BOOKS:

1. **A Course in Electrical Power**, Soni Gupta and Bhatnager-Dhanapat Rai & sons.
3. **Electrical Power**, Dr. S.L.Uppal, Khanna Publications

10EE73 HIGH VOLTAGE ENGINEERING

Subject Code	:	10EE73	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Introduction to HV technology, need for generating high voltages in laboratory. Industrial applications of high voltage, Electrostatic precipitation, separation, painting and printing.

6Hours

UNIT - 2 & 3

BREAKDOWN PHENOMENA: Classification of HV insulating media. Properties of important HV insulating media under each category. Gaseous dielectrics, Ionization: primary and secondary ionization processes. Criteria for gaseous insulation breakdown based on Townsend's theory. Limitations of Townsend's theory. Streamer's theory breakdown in non uniform fields. Corona discharges. Breakdown in electro negative gases. Paschen's law and its significance. Time lags of Breakdown. Breakdown in solid dielectrics: Intrinsic Breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown. Breakdown of liquid dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown (bubble's theory), electro convection breakdown.

12 Hours

UNIT - 4

GENERATION OF HV AC AND DC VOLTAGE: HV AC-HV transformer; Need for cascade connection and working of transformers units connected in cascade. Series resonant circuit- principle of operation and advantages. Tesla coil. HV DC- voltage doubler circuit, cockcroft- Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop.

8 Hours

Part - B

UNIT - 5

GENERATION OF IMPULSE VOLTAGE AND CURRENT: Introduction to standard lightning and switching impulse voltages. Analysis of single stage impulse generator-expression for Output impulse voltage. Multistage impulse generator working of Marx impulse. Rating of impulse generator. Components of multistage impulse generator. Triggering of impulse generator by three electrode gap arrangement. Trigatron gap and oscillograph time sweep circuits. Generation of switching impulse voltage. Generation of high impulse current.

6 Hours

UNIT - 6

MEASUREMENT OF HIGH VOLTAGES: Electrostatic voltmeter-principle, construction and limitation. Chubb and Fortescue method for HV AC measurement. Generating voltmeter- Principle, construction. Series resistance micro ammeter for HV DC measurements. Standard sphere gap measurements of HV AC, HV DC, and impulse voltages; Factors affecting the measurements. Potential dividers-resistance dividers capacitance dividers mixed RC potential dividers. Measurement of high impulse currents-Rogowski coil and Magnetic Links.

10 Hours

UNIT - 7

NON-DESTRUCTIVE INSULATION TESTING TECHNIQUES: Dielectric loss and loss angle measurements using Schering Bridge, Transformer ratio Arms Bridge. Need for discharge detection and PD measurements aspects. Factor affecting the discharge detection. Discharge detection methods-straight and balanced methods. **6 Hours**

UNIT - 8

HIGH VOLTAGE TESTS ON ELECTRICAL APPARATUS: Definitions of terminologies, tests on isolators, circuit breakers, cables insulators and transformers. **4 Hours**

TEXT BOOKS:

1. **High Voltage Engineering**, M.S.Naidu and Kamaraju- 4th Edition, THM, 2008.
2. **High Voltage Engineering Fundamentals**, E.Kuffel and W.S. Zaengl, 2nd Edition, Elsevier Press, 2005.
3. **High Voltage Engineering**, C.L.Wadhwa, New Age International Private limited, 1995.

REFERENCE BOOKS:

1. **High Voltage Engineering Theory and Practice**, Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, Roshdy Radwan, 2nd Edn(Revised & Expanded) Marcel-Dekker Publishers(Special Indian Edn.).

10EE74 INDUSTRIAL DRIVES & APPLICATIONS

Subject Code	:	10EE74	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

AN INTRODUCTION TO ELECTRICAL DRIVES & ITS DYNAMICS: Electrical drives. Advantages of electrical drives. Parts of electrical drives, choice of electrical drives, status of dc and ac drives, Dynamics of electrical drives, Fundamental torque equation, speed torque conventions and multi-quadrant operation. Equivalent values of drive parameters, components of low torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization. **9 Hours**

UNIT - 2

SELECTION OF MOTOR POWER RATING: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating. **5 Hours**

UNIT - 3 & 4**D C MOTOR DRIVES:**

- (a) Starting braking, transient analysis, single phase fully controlled rectifier, control of separately excited dc motor, Single-phase half controlled rectifier control of separately excited dc motor.
- (b) Three phase fully controlled rectifier - control of separately excited dc motor, three phase half controlled rectifier - control of separately excited dc motor, multi-quadrant operation of separately excited dc motor fed from fully controlled rectifier. Control of dc series motor, chopper controlled dc drives- separately excited dc motor and series motor. **12 Hours**

PART - B**UNIT - 5****INDUCTION MOTOR DRIVES:**

Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis.

06 Hours**UNIT - 6****Stator voltage control:**

Variable voltage and variable frequency control, voltage source inverter control, closed loop control, current source inverter control, rotor resistance control, slip power recovery, speed control of single phase induction motors.

06 Hours**UNIT - 7**

SYNCHRONOUS MOTOR DRIVES: Operation from fixed frequency supply, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyristor inverter.

10 Hours**UNIT - 8**

INDUSTRIAL DRIVES: Rolling mill drives, cement mill drives, paper mill drives and textile mill drives.

4 Hours**TEXT BOOK:**

1. **Fundamentals of Electrical Drives**, G.K Dubey , Narosa publishing house, 2nd Edition,2002.

REFERENCE BOOKS:

1. **Electrical Drives**, N.K De and P.K. Sen- PHI, 2009.
2. **A First Course On Electric Drives**, S.K Pillai-Wiley Eastern Ltd 1990.
3. **Power Electronics, Devices, Circuits and Industrial Applications**, V.R. Moorthi, -Oxford University Press, 2005.
4. **Electric Motor Drives, Modeling, Analysis and Control**, R.Krishnan, PHI, 2008.

ELECTIVES-II(GROUP B)

10EE756 TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT

Subject Code	:	10EE756	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

TRANSFORMERS:

a. Specifications: Power and distribution transformers as per BIS standards.

b. Installation: Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection.

5 Hours

c. Commissioning tests: Following tests as per national & International Standards, volt ratio test, earth resistance, oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test.

7 Hours

d. Specific Tests: Determination of performance curves like efficiency, regulation etc, and determination of mechanical stress under normal & abnormal conditions.

3 Hours

UNIT - 3 & 4

SYNCHRONOUS MACHINES:

a. Specifications: As per BIS standards.

b. Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out.

c. Commissioning Tests: Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance.

4 Hours

d. Performance tests: Various tests to estimate the performance of generator operations, slip test, maximum lagging current, maximum reluctance power tests, sudden short circuit tests, transient & sub transient parameters, measurements of sequence impedances, capacitive reactance, and separation of losses, temperature rise test, and retardation tests.

6 Hours

e. **Factory tests:** Gap length, magnetic eccentricity, balancing vibrations, bearing performance.

2 Hours

PART - B

UNIT - 5, 6 & 7

INDUCTION MOTORS:

a. **Specifications** for different types of motors, Duty, I.P. protection.

2 Hours

b. **Installation:** Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling, fitting of pulleys & coupling, drying of windings.

4 Hours

c. **Commissioning Test:** Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing.

5 Hours

Electrical Tests: Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test, factory test and site test (in accordance with ISI code)

4 Hours

d. **Specific Tests:** Performance & temperature raise tests, stray load losses, shaft alignment, and re-rating & special duty capability.

4 Hours

UNIT - 8

SWITCH GEAR & PROTECTIVE DEVICES: Standards, types, specification, installation, commissioning tests, maintenance schedule, type & routine tests.

6 Hours

TEXT BOOKS:

1. **Testing & Commissioning Of Electrical Equipment** -S. Rao,Khanna Publishers,2004
2. **Testing & Commissioning Of Electrical Equipment** -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.

REFERENCE BOOKS:

1. **Relevant Bureau of Indian Standards**
2. **A Handbook on Operation and Maintenance of Transformers-** H. N. S. Gowda, Published by H. N. S. Gowda,2006
3. **Handbook of SwitchGears,BHEL, TMH,2005.**
4. **J and P Transformer Book,Elsevier Publication.**

ELECTIVES-II (GROUP C)

10EE761 POWER SYSTEM PLANNING

Subject Code	:	10EE761	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1**

INTRODUCTION OF POWER PLANNING, National and regional planning, structure of power system, planning tools, electricity regulation, Load forecasting, forecasting techniques, modeling. **8 Hours**

UNIT - 2 & 3

GENERATION PLANNING, Integrated power generation, co-generation / captive power, power pooling and power trading, transmission & distribution planning, power system economics, power sector finance, financial planning, private participation, rural electrification investment, concept of rational tariffs.

10 Hours**UNIT - 4**

COMPUTER AIDED PLANNING: Wheeling, environmental effects, green house effect, technological impacts, insulation co-ordination, reactive compensation.

8 Hours**PART - B****UNIT - 5 & 6**

POWER SUPPLY RELIABILITY, reliability planning, system operation planning, load management, load prediction, reactive power balance, online power flow studies, test estimation, computerized management. Power system simulator.

10 Hours**UNIT - 7 & 8**

Optimal Power system expansion planning, formulation of least cost optimization problem incorporating the capital, operating and maintenance cost of candidate plants of different types (thermal hydro nuclear non conventional etc), Optimization techniques for solution by programming. **16 Hours**

TEXT BOOK:

1. **Electrical Power System Planning**, A.S.Pabla, Macmillan India Ltd, 1998

10EEL77 Relay and High Voltage Laboratory

Subject Code	:	10EEL77	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

(Total 12 experiments are to be conducted by choosing at least 03 experiments from part A, 02 each from part-B and C and 05 from part-D)

PART - A

1. Over current relay :
 - (a) IDMT non-directional characteristics
 - (b) Directional features
 - (c) IDMT directional
2. IDMT characteristics of over voltage or under voltage relay.(solid state or electromechanical type
3. (a) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.
(b) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator.
Operating characteristics of over voltage or under voltage relay. (Solid state or electromechanical type).
4. Operation of negative sequence relay.
5. Bias characteristics of differential relay.
6. Current-time characteristics of fuse.

PART - B

1. Operating characteristics of microprocessor based (numeric) over –current relay.
2. Operating characteristics of microprocessor based (numeric) distance relay.
3. Operating characteristics of microprocessor based (numeric) over/under voltage relay.

PART - C

1. Generator protection –Merz-Price- protection scheme.
2. Feeder protection scheme-fault studies.
3. Motor protection scheme-fault studies.

PART - D

1. Spark over characteristics of air insulation subjected to high voltage AC with spark over voltage corrected to STP.
2. Spark over characteristics of air insulation subjected to high voltage AC, with spark over voltage corrected to STP for uniform and non-uniform field configuration.
3. Spark over characteristics of air insulation subjected to high voltage DC
4. Measurement of HVAC and HVDC using standard spheres.
5. Breakdown strength of transformer oil using oil-testing unit.
6. Field mapping using electrolytic tank for any one-model cable/capacitor/transmission line/ Sphere gap models.

10EEL78 Power System Simulation Laboratory

Subject Code	:	10EEL78	IA Marks	:	25
No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

Power system simulation using MATLAB/ C or C ++ /Sci lab /octave

1. a) Y Bus formation for power systems with and without mutual coupling, by singular transformation and inspection method.
b) Determination of bus currents, bus power and line flow for a specified system voltage (Bus) Profile
2. Formation of Z-bus(without mutual coupling) using Z-bus building Algorithm .
3. ABCD parameters: Formation for symmetric π/T configuration. Verification of $AD-BC=1$
Determination of efficiency and regulation
4. Determination of power angle diagrams, reluctance power, excitation, emf and regulation for salient and non-salient pole synchronous machines,.
- 5 To obtain swing curve and to determine critical clearing time and regulation for a single machine connected to infinity bus through a pair of identical transmission lines under 3-phase fault on one of the lines for variation of inertia constant/line parameters /fault location/clearing time/pre-fault electrical output.
6. Formation of Jacobian for a system not exceeding 4 buses (no PV buses) in polar coordinates
7. Write a program to perform load using Gauss- Seidel method (only p q bus)
8. To determine fault currents and voltages in a single transmission line system with star-delta transformers at a specified location for LG, LLG.
9. Load flow analysis using Gauss Siedel method, NR method, Fast decoupled method for both pq and pv buses.
10. Optimal Generation Scheduling for Thermal power plants.

Note: Questions 1-7: Simulation Experiments using MATLAB/C or C++/Scilab/Octave

Questions 8-10: Use suitable standard software package.

**FINAL SCHEME OF TEACHING & EXAMINATION AND SYLLABUS - DATED 16TH AND 17TH
APRIL 2010**

VIII

SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10EE81	Electrical Design, Estimating and Costing	E&EE	4	-	3	25	100	125
2	10EE82	Power System Operation and Control	E&EE	4	-	3	25	100	125
3	10EE83X	Elective-IV (Group D)	E&EE	4	-	3	25	100	125
4	10EE84X	Elective-V (Group E)	E&EE	4	-	3	25	100	125
5	10EEP85	Project Work	E&EE	-	6	3	100	100	200
6	10EES86	Seminar (on a latest topic relevant to the branch and independent of the project work)	E&EE	-	3	-	50	-	50
Total				16	09	15	250	500	750

Elective-IV (Group-D)

10EE831 - Reactive Power Management
 10EE832 - Flexible A.C. Transmission Systems (FACTS)
 10EE833- Advanced Instrumentation System
 10EE834 - AI Applications to Power Systems
 10EE835 - Data Base Management Systems (DBMS)
 10EE836 - Renewable Energy Sources

Elective-V (Group-E)

10EE841 - Power Systems Dynamics and Stability
 10EE842 - Energy Auditing & Demand Side management
 10EE843 - Data communications and Networking
 10EE844 - Electrical Distribution Systems
 10EE845 - Insulation Engineering
 10EE846 - Intellectual Property Rights
 10EE847 - Electrical Power Quality

10EE81 ELECTRICAL DESIGN, ESTIMATING AND COSTING

Subject Code	: 10EE81	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A

UNIT: 1

GENERAL PRINCIPLES OF ESTIMATION: Introduction to estimation & costing, Electrical Schedule, Catalogues, Market Survey and source selection, Recording of estimates, Determination of required quantity of material, Labor conditions, Determination of cost material and labour, Contingencies, Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Tender form, General idea about IE rule, Indian Electricity Act and major applicable I.E rules. **6Hours**

UNIT: 2

RESIDENTIAL BUILDING ELECTRIFICATION: General rules guidelines for wiring of residential installation and positioning of equipments, Principles of circuit design in lighting and power circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires and cables, Load calculations and selection of size of conductor, Selection of rating of main switch, distribution board, protective switchgear ELCB and MCB and wiring accessories, Earthing of residential Installation, Sequence to be followed for preparing estimate, Preparation of detailed estimates and costing of residential installation. **7Hours**

UNIT:3

ELECTRIFICATION OF COMMERCIAL INSTALLATION: Concept of commercial installation, Differentiate between electrification of residential and commercial installation, Fundamental considerations for planning of an electrical installation system for commercial building, Design considerations of electrical installation system for commercial building, Load calculation and selection of size of service connection and nature of supply, Deciding the size of the cables, busbar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch etc, Earthing of the electrical installation, Selection of type wire, wiring system and layout, Sequence to be followed to prepare estimate, Preparation of detailed estimate and costing of commercial installation. **7Hours**

UNIT: 4

SERVICE CONNECTION, INSPECTION AND TESTING OF INSTALLATION: Concept of service connection, Types of service connection and their features, Method of installation of service connection, Estimates of under ground and overhead service connections, Inspection of internal wiring installations, Inspection of new installations, Testing of installations, Testing of wiring installations, Reason for excess recording of energy consumption by energy meter. **6Hours**

PART- B

UNIT: 5

ELECTRICAL INSTALLATION FOR POWER CIRCUITS: Introduction, Important considerations regarding motor installation wiring, Determination of input power, Determination of input current to motors, Determination of rating of cables, determination of rating of fuse, Determination of size of Conduit, distribution Board main switch and starter. **6Hours**

UNIT:6 and 7**DESIGN AND ESTIMATION OF OVERHEAD TRANSMISSION & DISTRIBUTION LINES:**

Introduction, Typical AC electrical power system, Main components of overhead lines, Line supports, Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers, Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, Setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators, Jumpers, Tee-offs, Earthing of transmission lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between conductors, Testing and commissioning of overhead distribution lines, Some important specifications. **12Hours**

UNIT: 8

DESIGN AND ESTIMATION OF SUBSTATIONS:Introduction, Classification of substation, Indoor substations, Outdoor substations, Selection and location of site for substation, Main Electrical Connections, Graphical symbols for various types of apparatus and circuit elements on substation main connection diagram, Key diagram of typical substations, Equipment for substation and switchgear installations, Substation auxiliaries supply, Substation Earthing **6Hours**

TEXT BOOK:

1. **Electrical Installation Estimating & Costing**, J.B.Gupta, VIII Edition S.K. Katria & Sons New Delhi

REFERENCE BOOKS :

1. **Electrical Design Estimating and Costing**, K.B.Raina S.K.Bhattacharya, New Age International
2. **Electrical Wiring Estimating and Costing**, Uppal, Khanna Publishers Delhi
3. **I.E.Rules and Act Manuals**

10EE82 POWER SYSTEM OPERATION AND CONTROL

Subject Code	:	10EE82	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A**UNIT - 1****CONTROL CENTER OPERATION OF POWER SYSTEMS:**

Power system control and operating states, control center, digital computer configuration, automatic generation control, area control error, operation without central computers, expression for tie-line flow and frequency deviation, parallel operation of generators, area lumped dynamic model. **8 Hours**

UNIT - 2 & 3

AUTOMATIC VOLTAGE REGULATOR: Basic generator control loops, Cross-coupling between control loops, Exciter types, Exciter modeling, Generator modeling, Static performance of AVR loop.

AUTOMATIC LOAD FREQUENCY CONTROL:

Automatic Load frequency control of single area systems, Speed governing system, Hydraulic valve actuator, Turbine generator response, Static performance of speed governor, Closing of ALFC loop, Concept of control area, Static response of primary ALFC loop, Integral control, ALFC of multi-control area systems (POOL operation), The Two-Area system, Modeling the Tie-Line, Block Diagram representation of Two-Area system, Static response of Two-Area system and Tie-Line Bias control.

12 Hours

UNIT - 4

CONTROL OF VOLTAGE AND REACTIVE POWER: Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse.

6 Hours

PART - B**UNIT - 5**

OPTIMAL SYSTEM OPERATION AND UNIT COMMITMENT: Introduction , Optimal operation of generators on a bus bar, Statement of the Unit Commitment problem, need and importance of unit commitment, Constraint in Unit Commitment, Unit Commitment solution methods-Priority lists method, Forward Dynamic Programming method(excluding problem), Spinning reserve.

6 Hours

UNIT - 6

POWER SYSTEM SECURITY: Introduction, factors affecting power system security, Security analysis, Contingency Selection, Techniques for contingency evaluation-D.C. load flow and fast decoupled load flow.

6 Hours

UNIT 7

SYSTEM MONITORING AND CONTROL: Introduction , Energy management system, the basis of power system state estimation(PSSE), mathematical description of PSSE process, minimization technique for PSSE, Least Square estimation, Error and detection in PSSE, System security and emergency control.

6 Hours

UNIT- 8

POWER SYSTEM RELIABILITY: Introduction, Modes of failures of a system, Generating system and its performance, derivation of reliability index, reliability measure for N- unit system, cumulative probability outages- Recursive Relation, Loss of load probability, Frequency and duration of a state.

8 Hours

Text Books:

1. **Modern Power System Analysis-** I J Nagarath and D P Kothari, TMH, 3rd Edition, 2003
2. **Electrical Energy Systems Theory,** O.J Elgerd, TMH,2008.
3. **Power generation, operation and control-** Allen J Wood & Woollenberg. John Wiley and Sons, Second Edition, 2009.
4. **Electric Power Systems-** B.M.Weedy and B.J. Cory, Wiley student edition, 1999
5. **Computer Aided Power System Operation and Analysis-** R.N. Dhar, Tata McGraw-Hill, 1987.

REFERENCE:

1. **Computer Aided Power System Analysis-** G.L.Kusic, PHI,2010.
2. **Power System Analysis, Operation and Control,** Abhijit Chakrabarti and Sunita Halder, PHI, Second Edition, 2009
3. **Power system stability and control,** Prabha Kundur, TMH, 9th reprint, 2007.

ELECTIVE – IV (GROUP - D)

10EE836 RENEWABLE ENERGY SOURCES

Subject Code	: 10EE836	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

ENERGY SOURCES: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. **4 Hours**

UNIT - 2

SOLAR ENERGY BASICS: Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer. **6 Hours**

UNIT - 3

SOLAR THERMAL SYSTEMS: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses. **6 Hours**

UNIT - 4

SOLAR ELECTRIC SYSTEMS: Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems. **7 Hours**

ENERGY STORAGE: Introduction, Necessity of Energy Storage, and Methods of Energy Storage (classification and brief description using block diagram representation only). **3 Hours**

PART - B

UNIT - 5

WIND ENERGY: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Wind site selection consideration, Advantages and Disadvantages of WECS. **8 Hours**

UNIT - 6

BIOMASS ENERGY: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. **6 Hours**

UNIT - 7

ENERGY FROM OCEAN: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Estimation of Energy – Single basin and Double basin type TPP (no derivations. Simple numerical problems), Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC. **6 Hours**

UNIT - 8

EMERGING TECHNOLOGIES: Fuel Cell, Small Hydro Resources, Hydrogen Energy, and Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations). **6 Hours**

TEXT BOOKS:

1. **Non-Conventional Sources of Energy**, Rai, G. D, Khanna Publishers, 4th Edition, 2007
2. **Non-Conventional Energy Resources**, Khan, B. H., TMH, 2nd Edition.

REFERENCE BOOK:

1. **Fundamentals of Renewable Energy Systems**, Mukherjee, D and Chakrabarti, S., New Age International Publishers, 2005.

ELECTIVE –V (GROUP - E)**10EE842 ENERGY AUDITING & DEMAND SIDE MANAGEMENT**

Subject Code	: 10EE842	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

INTRODUCTION: Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation. **6 Hours**

UNIT - 2

ENERGY ECONOMIC ANALYSIS: The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems. **7 Hours**

UNIT - 3

ENERGY AUDITING: Introduction, Elements of energy audits, energy use profiles, measurements in energy audits, presentation of energy audit results. **8 Hours**

UNIT - 4

ELECTRICAL SYSTEM OPTIMIZATION: The power triangle, motor horsepower, power flow concept. **5 Hours**

PART - B**UNIT - 5 & 6**

ELECTRICAL EQUIPMENT AND POWER FACTOR –correction & location of capacitors, energy efficient motors, lighting basics, electrical tariff, Concept of ABT. **10 Hours**

UNIT - 7 & 8

DEMAND SIDE MANAGEMENT: Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for

planning, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs. **16 Hours**

TEXT BOOKS:

1. **Industrial Energy Management Systems**, Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York
2. **Fundamentals of Energy Engineering** - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey.
3. **Electrical Power distribution**, A S. Pabla, TMH, 5th edition, 2004

REFERENCE BOOKS:

1. **Recent Advances in Control and Management of Energy Systems**, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
2. **Energy Demand – Analysis, Management and Conservation**, Ashok V. Desai, Wiley Eastern, 2005.
3. **Demand Side Management**, Jyothi Prakash, TMH Publishers.
4. **Hand book on energy auditing** - TERI (Tata Energy Research Institute)

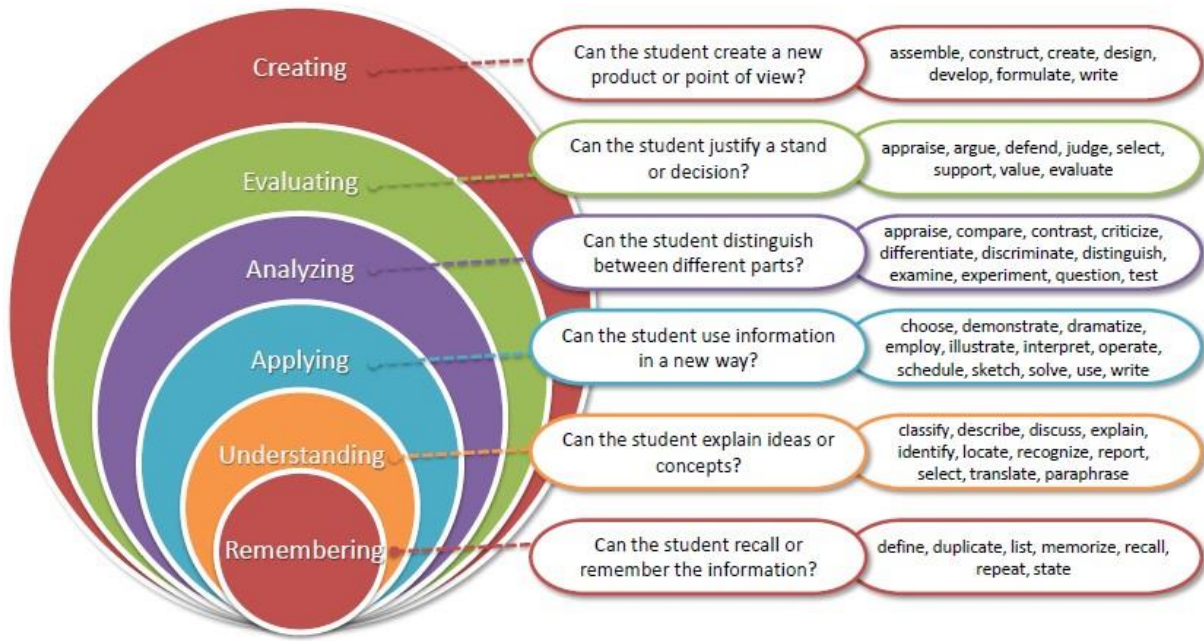
VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus B.E. ELECTRICAL AND ELECTRONICS ENGINEERING III TO VIII SEMESER (Effective from Academic year 2015-16)



CATEGORIZATION FOR THE THINKING PROCESS

Bloom's Taxonomy (Revised)



Bloom's Revised Taxonomy Levels, Level Definitions and attributes levels along with action verbs that can be used when developing learning outcomes.			
	Level	Level Definitions and attributes	Verbs(not comprehensive)
Lower order thinking skills (LOTS)	Remembering (Knowledge) <i>L₁</i>	Students exhibit memory/rote memorization of previously learnt materials by recognition, recalling facts, terms, basic concepts, and simple answers. Able to remember, but not necessarily fully understanding the material.	Copy, Choose, Define, Discover, Describe, Duplicate, Enumerate, Find, How, Identify, Label, List, Locate, Listen, Memorize, Match, Name, Omit, Quote, Recall, Relate, Reproduce, Recognize, Select, Show, Spell, Tell, Tabulate, Who, When, Where etc.
	Understanding (Comprehension) <i>L₂</i>	Students demonstrate understanding of facts and ideas by interpreting, exemplifying, classifying, inferring, summarizing, comparing and explaining main ideas with own words.	Ask, Classify, Compare, Contrast, Demonstrate, Describe, Extend, Differentiate, Distinguish, Discuss, Express, Explain, Group, Illustrate, Infer, Interpret, Outline, Paraphrase, Rephrase, Relate, Show, Summarize, Select, Translate, Restate etc.
	Applying (Application) <i>L₃</i>	Students solve problems in new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Build, Construct, Develop, Experiment With, Identify, Make Use Of, Organize, Plan, Select etc.
Higher order thinking skills (HOTS)	Analysing (Analysis) <i>L₄</i>	Students are able to examine and break information into component parts by identifying motives, causes arrangement, logic and semantics. They can make inferences and find evidence to support generalization.	Analyse, Assume, Break Down, Classify, Categorize, Conclusion, Compare, Contrast, Diagram, Discover, Dissect, Distinguish, Divide, Examine, Function, Illustrate, Inference, Inspect, List, Motive, Outline, Relationships, Simplify, Survey, Take Part In, Test For etc.
	Evaluating (Evaluation) <i>L₅</i>	Students are able to present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. They can justify a decision or course of action.	Agree, Appraise, Assess, Award, Build, Create, Compose, Choose, Compare, Conclude, Criteria, Criticize, Design, Derive, Develop, Decide, Deduct, Determine, Disprove, Defend, Estimate, Formulate, Generate, Invent, Modify, Evaluate, Explain, Influence, Judge, Interpret, Justify, Mark, Measure, Perceive, Rate, Prioritize, Recommend, Rule On, Select, Support, Value etc.
	Creating (Synthesis) <i>L₆</i>	Students are able to compile, generate or view information, ideas or products together in a different way by combining elements in a new pattern or by proposing alternative solutions. Also, use information to form a unique product. This requires creativity and originality.	Assemble, Adapt, Anticipate, Build, Change, Choose, Combine, Collaborate, Collect, Create, Compile, Compose, Construct, Delete, Design, Develop, Discuss, Develop, Devise, Elaborate, Estimate, Formulate, Happen, Hypothesize, Imagine, Improve, Invent, Imagine, Intervene, Make Up, Maximize, Modify, Originate, Plan, Predict, Propose, Rearrange, Solve, Suppose, Substitute, Test etc.
<p>Graduate attributes: Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future.</p> <p style="text-align: right;">Bowden, Hart, King, Trigwell & Watts (2000)</p>			

Scheme of Teaching and Examination

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

III SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Dept.	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15MAT31	Core Subject	Engineering Mathematics-III	Mathe matics	04	--	03	20	80	100	4
2	15EE32	Core Subject	Electric Circuit Analysis	EEE	04	--	03	20	80	100	4
3	15EE33	Core Subject	Transformers and Generators	EEE	04	--	03	20	80	100	4
4	15EE34	Core Subject	Analog Electronic Circuits	EEE	04	--	03	20	80	100	4
5	15EE35	Core Subject	Digital System Design	EEE	04	--	03	20	80	100	4
6	15EE36	Foundation Course	Electrical and Electronic Measurements	EEE	04	--	03	20	80	100	4
7	15EEL37	Laboratory	Electrical Machines Laboratory -1	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
8	15EEL38	Laboratory	Electronics Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
TOTAL					Theory:24 hours Practical: 06 hours		24	160	640	800	28

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. FoundationCourse: The courses based upon the content that leads to Knowledge enhancement.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

IV SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Dept.	Teaching Hours /Week		Examination			Credits	
					Theory	Practical/ Drawing	Duration in hours	L.A. Marks	Theory/ Practical Marks		Total Marks
1	15MAT41	Core Subject	Engineering Mathematics-IV	Maths	04	--	03	20	80	100	4
2	15EE42	Core Subject	Power Generation and Economics	EEE	04	--	03	20	80	100	4
3	15EE43	Core Subject	Transmission and Distribution	EEE	04	--	03	20	80	100	4
4	15EE44	Core Subject	Electric Motors	EEE	04	--	03	20	80	100	4
5	15EE45	Core Subject	Electromagnetic Field Theory	EEE	04	--	03	20	80	100	4
6	15EE46	Foundation Course	Operational Amplifiers and Linear ICs	EEE	04	--	03	20	80	100	4
7	15EEL47	Laboratory	Electrical Machines Laboratory -2	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
8	15EEL48	Laboratory	Op- amp and Linear ICs Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
TOTAL					Theory:24 hours Practical: 06 hours		24	160	640	800	28

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Foundation Course: The courses based upon the content that leads to Knowledge enhancement.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

V SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15EE51	Core Subject	Management and Entrepreneurship	EEE	04	--	03	80	20	100	4
2	15EE52	Core Subject	Microcontroller	EEE	04	--	03	80	20	100	4
3	15EE53	Core Subject	Power Electronics	EEE	04	--	03	80	20	100	4
4	15EE54	Core Subject	Signals and Systems	EEE	04	--	03	80	20	100	4
5	15EE55X	Professional Elective	Professional Elective – I	EEE	03	--	03	80	20	100	3
6	15EE56Y	Open Elective	Open Elective - I	EEE	03	--	03	80	20	100	3
7	15EEL57	Laboratory	Microcontroller Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	80	20	100	2
8	15EEL58	Laboratory	Power Electronics Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
TOTAL					Theory:22hours Practical: 06 hours		24	160	640	800	26

Elective**Professional Elective****Open Elective^{***}****Offered by the Department of Electrical and Electronics Engineering**

Courses under Code 15EE55X	Title	Courses under Code 15EE55X	Title
15EE551	Introduction to Nuclear Power	15EE561	Electronic Communication systems
15EE552	Electrical Engineering Materials	15EE562	Programmable Logic controllers
15EE553	Estimating and Costing	15EE563	Renewable Energy Systems
15EE554	Special Electrical Machines	15EE564	Business Communication

*** Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives). Selection of an open elective is not allowed provided;

- The candidate has pre – requisite knowledge.
- The candidate has not studied during I and II year of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters.

Registration to electives shall be documented under the guidance of Programme Coordinator and Adviser.

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Electives relevant to chosen specialization/ branch.

3. Open Elective: Electives from other technical and/ or emerging subject areas.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VI SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15EE61	Core Subject	Control Systems	EEE	04	--	03	80	20	100	4
2	15EE62	Core Subject	Power System Analysis – 1	EEE	04	--	03	80	20	100	4
3	15EE63	Core Subject	Digital Signal Processing	EEE	04	--	03	80	20	100	4
4	15EE64	Core Subject	Electrical Machine Design	EEE	04	--	03	80	20	100	4
5	15EE65X	Professional Elective	Professional Elective – II	EEE	03	--	03	80	20	100	3
6	15EE66Y	Open Elective	Open Elective - II	EEE	03	--	03	80	20	100	3
7	15EEL67	Laboratory	Control System Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	80	20	100	2
8	15EEL68	Laboratory	Digital Signal Processing Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
TOTAL					Theory:22 hours Practical: 06 hours		24	160	640	800	26

Elective

Professional Elective		Open Elective ^{***}	
		Offered by the Department of Electrical and Electronics Engineering	
Courses under Code 15EE65X	Title	Courses under Code 15EE66Y	Title
15EE651	Computer Aided Electrical Drawing	15EE661	Artificial Neural Networks and Fuzzy logic
15EE652	Advanced Power Electronics	15EE662	Sensors and Transducers
15EE653	Energy Audit and Demand side Management	15EE663	Batteries and Fuel Cells for Commercial, Military and Space Applications
15EE654	Solar and Wind Energy	15EE664	Industrial Servo Control Systems

^{***}Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives). Selection of an open elective is not allowed provided;

- The candidate has pre – requisite knowledge.
- The candidate has not studied during I and II year of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters.

Registration to electives shall be documented under the guidance of Programme Coordinator and Adviser.

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Electives relevant to chosen specialization/ branch.

3. Open Elective: Electives from other technical and/ or emerging subject areas.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16 B.E. ELECTRICAL AND ELECTRONICS ENGINEERING CHOICE BASED CREDIT SYSTEM (CBCS)

VII SEMESTER

Sl. No	Course Code	Subject (Course)	Title	Teaching Department	Teaching Hours/Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EE71	Core Subject	Power System Analysis - 2	EEE	04	--	03	20	80	100	4
2	15EE72	Core Subject	Power System Protection	EEE	04	--	03	20	80	100	4
3	15EE73	Core Subject	High Voltage Engineering	EEE	04	--	03	20	80	100	4
4	15EE74X	Professional Elective	Professional Elective – III	EEE	04	--	03	20	80	100	3
5	15EE75Y	Professional Elective	Professional Elective – IV	EEE	04	--	03	20	80	100	3
6	15EEL76	Laboratory	Power system Simulation Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	20	80	100	2
7	15EEL77	Laboratory	Rely and High Voltage Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	20	80	100	2
8	15EEP78	Project Phase – I + Seminar		EEE	--		--	100	--	100	2
TOTAL					Theory:24 hours Practical: 06 hours		21	240	560	800	24

Elective

Professional Elective – III

Professional Elective – IV

Courses under Code 15EE74X	Title	Courses under Code 15EE75Y	Title
15EE741	Advanced Control Systems	15EE751	FACTs and HVDC Transmission
15EE742	Utilization of Electrical Power	15EE752	Testing and Commissioning of Power System Apparatus
15EE743	Carbon Capture and Storage	15EE753	Spacecraft Power Technologies
15EE744	Power System Planning	15EE754	Industrial Heating

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch.

3. Project Phase –I + Seminar: Literature Survey, Problem Identification, objectives and Methodology. Submission of synopsis and seminar.

4. Internship / Professional Practice: To be carried between the VI and VII semester vacation or VII and VIII semester vacation period.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VIII SEMESTER

Sl. No	Course Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination			Credits	
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks		Total Marks
1	15EE81	Core Subject	Power System Operation and Control	EEE	04	--	03	20	80	100	4
2	15EE82	Core Subject	Industrial Drives and Applications	EEE	04	--	03	20	80	100	4
3	15EE83X	Professional Elective	Professional Elective – V	EEE	03	--	03	20	80	100	3
4	15EE84	Core Subject	Internship / Professional Practice	EEE	Industry Oriented		03	50	50	100	2
5	15EEP85	Core Subject	Project Work Phase -II	EEE	--	06	03	100	100	200	6
6	15EES86	Core Subject	Seminar	EEE	--	04	--	100	--	100	1
TOTAL					Theory:11 hours Practical: 10 hours		15	310	390	700	20

Professional Elective – V

Courses under Code 15EE83X	Title
15EE831	Smart Grid
15EE832	Operation and Maintenance of Solar Electric Systems
15EE833	Integration of Distributed Generation
15EE834	Power System in Emergencies

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch.

3. Internship / Professional Practice: To be carried between the VI and VII semester vacation or VII and VIII semester vacation period.

III SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ENGINEERING MATHEMATICS –III (Core Course)			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to learn Fourier series, Fourier transforms and Z-transforms, statistical methods , numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variations. ■ 			
Module-1			Teaching Hours
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula-Falsi Method and Newton-Raphson method. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof) – Problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-5			
Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15MAT31 ENGINEERING MATHEMATICS –III (Core Subject) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functional and solve the simple problems of the calculus of variations. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Text Books				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	2006
5	Higher Engineering Mathematics	H. K.DassEr. Rajnish Verma	S.Chand	First Edition, 2011
Web links and Video Lectures: 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRIC CIRCUIT ANALYSIS (Core Subject)			
Subject Code	15EE32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To familiarize the basic laws, source transformations, theorems and the methods of analysing electrical circuits. • To explain the concept of coupling in electric circuits and resonance. • To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs. • To analyze the transient response of circuits with dc and sinusoidal ac input. • To impart basic knowledge on network analysis using Laplace transforms. ■ 			
Module-1			Teaching Hours
Basic Concepts: Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources. Equilibrium equations using KCL and KVL, Duality. Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances. Resonant frequency, Bandwidth and Quality factor at resonance. Practical RL-RC circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Network Theorems: Analysis of networks, with and without dependent ac and dc sources by Thevenin's and Norton's theorems. Analysis of ac and dc circuits for maximum power transfer to resistive and complex loads. Application of Millman's theorem and Super Position theorem to multisource networks. Reciprocity theorem and its application. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Transient Analysis: Review of ordinary linear non homogeneous first and second order differential equations with constant coefficients. Transient analysis of ac and dc circuits by classical method. Transient analysis of dc and ac circuits. Behaviour of circuit elements under switching action ($t = 0$ and $t = \infty$). Evaluation of initial conditions. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. Laplace Transform of network and time domain solution for RL, RC and RLC networks for ac and dc excitations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Unbalanced Three phase systems: Analysis of three phase systems, calculation of real and reactive powers. Two Port networks: Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits. Network functions of one port and two port			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE32 ELECTRIC CIRCUIT ANALYSIS (Core Course) (continued)				
Module-5(continued)				Teaching Hours
Two Port networks (continued): networks, properties of poles and zeros of network functions. Complex Wave analysis: Analysis of simple circuits with non-sinusoidal excitation. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits. • Identify, formulate, and solve engineering problems in the area circuits and systems. • Analyze the solution and infer the authenticity of it. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Engineering Circuit Analysis	William H Hayt et al	McGraw Hill	8th Edition,2014
2	Engineering Circuit Analysis	J David Irwin et al	Wiley India	10th Edition,2014
3	Fundamentals of Electric Circuits	Charles K Alexander Matthew N O Sadiku	McGraw Hill	5th Edition,2013
4	Network Analysis	M.E. Vanvalkenburg	Pearson	3rd Edition,2014
5	Electric Circuits	MahmoodNahvi	McGraw Hill	5th Edition,2009
6	Introduction to Electric Circuits	Richard C Dorf and James A Svoboda	Wiley	9 th Edition,2015
7	Circuit Analysis; Theory and Practice	Allan H Robbins Wilhelm C Miller	Cengage	5 th Edition,2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
TRANSFORMERS AND GENERATORS (Core Course)			
Subject Code	15EE33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To understand the concepts of transformers and their analysis. • To suggest a suitable three phase transformer connection for a particular operation. • To understand the concepts of generator and to evaluate their performance. • To explain the requirement for the parallel operation of transformers and synchronous generators. ■ 			
Module-1			Teaching Hours
<p>Single phase Transformers: Review of Principle of operation, constructional details of shell type and core type single-phase transformers, EMF equation, losses and commercial efficiency, conditions for maximum efficiency (No question shall be set from the review portion). Salient features of ideal transformer, operation of practical transformer under no - load and on - load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency- commercial and all-day. Voltage regulation and its significance.</p> <p>Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups. Equivalent circuit of three phase transformers. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase. Load sharing in case of similar and dissimilar transformers.</p> <p>Autotransformers and Tap changing transformers: Introduction to auto transformer - copper economy, equivalent circuit, three phase auto connection and voltage regulation. Voltage regulation by tap changing – off circuit and on load.</p> <p>Tertiary winding Transformers: Necessity of tertiary winding, equivalent circuit and voltage regulation, tertiary winding in star/star transformers, rating of tertiary winding. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Transformers (continuation): Cause and effects of harmonics, Current inrush in transformers, noise in transformers. Objects of testing transformers, polarity test, Sumpner's test.</p> <p>Direct current Generator – Review of construction, types, armature windings, relation between no load and terminal voltage (No question shall be set from the review portion). Armature reaction, Commutation and associated problems, no load and full load characteristics. Reasons for reduced dependency on dc generators.</p> <p>Synchronous generators- Review of construction and operation of salient & non-salient pole synchronous generators (No question shall be set from the review portion). Armature windings, winding factors, emf equation. Harmonics – causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
<p>Synchronous generators (continuation): Generator load characteristic. Voltage regulation, excitation control for constant terminal voltage. Generator input and output. Parallel operation of</p>			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE33 TRANSFORMERS AND GENERATORS (Core Course) (continued)				
Module-4(continued)				Teaching Hours
Synchronous generators(continuation): generators and load sharing. Synchronous generator on infinite bus-bars – General load diagram, Electrical load diagram, mechanical load diagram, O – curves and V – curves. Power angle characteristic and synchronizing power.				
Synchronous generators(continuation): Effects of saliency, two-reaction theory, Direct and Quadrature reactance, power angle diagram, reluctance power, slip test. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Synchronous generators(continuation): Open circuit and short circuit characteristics, Assessment of reactance- short circuit ratio, synchronous reactance, adjusted synchronous reactance and Potier reactance. Voltage regulation by EMF, MMF, ZPF and ASA methods.				10
Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators. Starting, synchronizing and control. Hunting and dampers. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the construction and operation and performance of transformers. • Explain different connections for the three phase operations, their advantages and applications. • Explain the construction and operation of Synchronous machines and evaluate the regulation of synchronous machines by different methods. • Analyze the operation of the synchronous machine connected to infinite machine. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electric Machines	D. P. Kothari, et al	McGraw Hill	4 th Edition, 2011
2	Performance and Design of A.C. Machines	M. G. Say	CBS Publishers	3 rd Edition, 2002
3	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2 nd Edition, 2013
4	Electric Machines	MulukuntlaS.Sarma,at el	Cengage	1 st Edition, 2009
5	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6 th Edition, 2014
6	Electrical Machines	M.V. Deshpande	PHI Learning	1 st Edition, 2013
7	Electrical Machines	AbhijitChakrabarti et al	McGraw Hill	1 st Edition, 2015
8	A Textbook of Electrical Machines	K.R.SiddapuraD.B.Raval	Vikas	1 st Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ANALOG ELECTRONIC CIRCUITS (Core Course)			
Subject Code	15EE34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Provide the knowledge for the analysis of diode and transistor circuits. • Develop skills to design the electronic circuits like amplifiers and oscillators. • Highlight the importance of FET and MOSFET. ■ 			
Module-1			Teaching Hours
Diode Circuits: Review of diodes as rectifiers (No question shall be set from review portion). Diode clipping and clamping circuits. Transistor biasing and stabilization: Operating point, analysis and design of fixed bias circuit, self-bias circuit, Emitter stabilized bias circuit, voltage divider bias circuit, stability factor of different biasing circuits. Problems. Transistor switching circuits: Transistor switching circuits, PNP transistors, thermal compensation techniques. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Transistor at low frequencies: BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model, relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual. Transistor frequency response: General frequency considerations, low frequency response, Miller effect capacitance, high frequency response, multistage frequency effects. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
Multistage amplifiers: Cascade and cascode connections, Darlington circuits, analysis and design. Feedback amplifiers: Feedback concept, different types, practical feedback circuits, analysis and design of feedback circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Power amplifiers: Amplifier types, analysis and design of different power amplifiers, distortion in power amplifiers. Oscillators: Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
FETs: Construction, working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET, JFET and MOSFET amplifiers, analysis and design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE34 ANALOG ELECTRONIC CIRCUITS (Core Subject) (continued)				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Utilize the characteristics of transistor for different applications. • Design and analyze biasing circuits for transistor. • Design, analyze and test transistor circuitry as amplifiers and oscillators. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015
2	Integrated Electronics, Analysis and Digital Circuits and Systems	Jacob Millman et al	McGraw Hill	2nd Edition, 2009
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008
4	Microelectronics Circuits Analysis and Design	Muhammad Rashid	Cengage Learning	2 nd Edition, 2014
5	A Text Book of Electrical Technology, Electronic Devices and Circuits	B.L. Theraja, A.K. Theraja,	S. Chand	Reprint, 2013
6	Electronic Devices and Circuits	Anil K. Maini Vasha Agarval	Wiley	1st Edition, 2009
7	Electronic Devices and Circuits	S.Salivahanan N.Suresh	McGraw Hill	3rd Edition, 2013
8	Fundamentals of Analog Circuits	Thomas L Floyd	Pearson	2nd Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
DIGITAL SYSTEM DESIGN(Core Course)			
Subject Code	15EE35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of combinational circuit design. • To impart the knowledge of Sequential circuit design. • To provide the basic knowledge about VHDL & its use. ■ 			
Module-1			Teaching Hours
Principles of combinational logic: Definition of combinational, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. Incompletely specified functions (Don't care terms). Simplifying max - term equations. Quine -McClusky minimization technique, Quine - McClusky using don't care terms, Reduced Prime Implicant tables, Map entered variables. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Analysis and design of Combinational Logic: General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-using multiplexers as Boolean function generators. Adders and Subtractors-Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Sequential Circuits: Basic Bistable element, Latches, SR latch, application of SR latch, A Switch debouncer, The SR latch, The gated SR latch. The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The master-slave SR Flip-Flops, The master-slave JK Flip-Flop, Edge Triggered Flip-flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. Characteristic equations, Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 counters using clocked JK Flip-Flops Design of a Synchronous Mod-6 counter using clocked D, T, or SR Flip-Flops. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Sequential Design: Introduction, Mealy and Moore models, State machine notation, synchronous sequential circuit analysis and design. Construction of state Diagrams, Counters Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog. Data-Flow Descriptions: Highlights of Data flow descriptions, Structure of data-flow description, Data type-vectors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE35 DIGITAL SYSTEM DESIGN (Core Course) (continued)				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Design and analyze combinational & sequential circuits • Design circuits like adder, subtractor, code converter etc. • Understand counters and sequence generators. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Digital Logic Applications and	John M Yarbrough	CengageLearn	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill	1 st Edition, 2002
3	Logic and computer design Fundamentals	M. Morris Mano and Charles Kime	Pearson Learning	4 th Edition, 2014
4	Fundamentals of logic design	Charles H Roth, JR and Larry L. Kinney	Cengage Learning	6 th Edition, 2013
5	Fundamentals of Digital Circuits	A. Anand Kumar	PHI	3 rd Edition, 2014
6	Digital Logic Design and VHDL	A.A.Phadke, S.M.Deokar	Wiley India	1 st Edition, 2009
7	Digital Circuits and Design	D.P.Kothari J.S.Dhillon	Pearson	First Print 2015
8	HDL Programming (VHDL and Verilog)	Nazeih M. Botros	Cengage Learning	1 st Edition, 2011
9	Circuit Design and Simulation with VHDL	Volnei A Pedroni	PHI	2 nd Edition,

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course)			
Subject Code	15EE36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To understand the concept of units and dimensions. • To measure resistance, inductance, capacitance by use of different bridges. • To study the construction and working of various meters used for measurement. • To have the working knowledge of electronic instruments and display devices. ■ 			
Module-1			Teaching Hours
Units and Dimensions: Review of fundamental and derived units. SI units (No question shall be set from the review portion). Dimensional equations, problems. Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Measurement of Power, Energy, Power factor and Frequency: Review of Dynamometer wattmeter construction and operation (No question shall be set from the review portions), Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Review of Induction type energy meter construction and operation (No question shall be set from the review portions)]. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Extension of Instrument Ranges: Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characteristics, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT. Magnetic measurements: Introduction, measurement of flux/ flux density, magnetising force and leakage factor. Hopkinson permeameter. Measurement of iron loss by wattmeter method. A brief discussion on measurement of air gap flux and field strength. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electronic and digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), extra features offered by present day meters and their significance in billing. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course) (continued)				
Module-5				Teaching Hours
<p>Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. Display multiplexing and zero suppression.</p> <p>Recording Devices: Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders. Magnetic tape recorders, Direct recording, Frequency modulation recording, Pulse duration modulation recording, Digital tape recording, Ultraviolet recorders. Biomedical recorders, Electro Cardio Graph (ECG), Electroencephalograph, Electromyograph. Noise in reproduction. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the importance of units and dimensions. • Measure resistance, inductance and capacitance by different methods. • Explain the working of various meters used for measurement of power and energy. • Explain the working of different electronic instruments and display devices. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electrical and electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai and Co	10th Edition
2	A Course in Electronics and Electrical Measurements and Instrumentation	J. B. Gupta	Katson Books	2013 Edition
3	Electrical and electronic Measurements and Instrumentation	Er.R.K. Rajput	S Chand	5th Edition, 2012
4	Electrical Measuring Instruments and Measurements	S.C. Bhargava	BS Publications	2013
5	Modern Electronic Instrumentation and Measuring Techniques	Cooper D and A.D. Heifrick	Pearson	First Edition, 2015
6	Electronic Instrumentation and Measurements	David A Bell	Oxford University	3rd Edition, 2013
7	Electronic Instrumentation	H.S.Kalsi	McGraw Hill	3rd Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL MACHINES LABORATORY - 1			
Subject Code	15EEL37	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • Conducting of different tests on transformers and synchronous machines and evaluation of their performance. • Verify the parallel operation of two single phase transformers. • Study the connection of single phase transformers for three phase operation and phase conversion. • Study of synchronous generator connected to infinite bus. ■ 			
Sl. NO	Experiments		
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.		
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.		
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.		
4	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.		
5	Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.		
6	Scott connection with balanced and unbalanced loads.		
7	Separation of hysteresis and eddy current losses in single phase transformer.		
8	Voltage regulation of an alternator by EMF and MMF methods.		
9	Voltage regulation of an alternator by ZPF method.		
10	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.		
11	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.		
12	Power angle curve of synchronous generator.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Conduct different tests on transformers and synchronous generators and evaluate their performance. • Connect and operate two single phase transformers of different KVA rating in parallel. • Connect single phase transformers for three phase operation and phase conversion. • Assess the performance of synchronous generator connected to infinite bus. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ELECTRONICS LABORATORY			
Subject Code	15EEL38	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To design and test half wave and full wave rectifier circuits. • To design and test different amplifier and oscillator circuits using BJT. • To study the simplification of Boolean expressions using logic gates. • To realize different Adders and Subtractors circuits. • To design and test counters and sequence generators. ■ 			
Sl. No	Experiments		
1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.		
2	Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.		
3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.		
4	Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.		
5	Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.		
6	Simplification, realization of Boolean expressions using logic gates/Universal gates.		
7	Realization of half/Full adder and Half/Full Subtractors using logic gates.		
8	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion and Vice - Versa.		
9	Realization of Binary to Gray code conversion and vice versa.		
10	Design and testing Ring counter/Johnson counter.		
11	Design and testing of Sequence generator.		
12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192, 74193.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Design and test different diode circuits. • Design and test amplifier and oscillator circuits and analyse their performance. • Use universal gates and ICs for code conversion and arithmetic operations. • Design and verify on of different counters. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

IV SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
ENGINEERING MATHEMATICS –IV (Core Subject)			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. ■			
Module-1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations of formulae). ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method. Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to J _n (x)-Bessel's function of first kind. Basic properties, recurrence relations and orthogonality. Series solution of Legendre's differential equation leading to P _n (x)-Legendre polynomials. Rodrigue's formula, problems. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems. Transformations: Conformal transformations, discussion of transformations: $w = z^2$, $w = e^z$, $w = z + (1/z)(z \neq 0)$ and bilinear transformations-problems. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems. Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
15MAT41 ENGINEERING MATHEMATICS – IV (Core Subject) (continued)				
Course outcomes:				
<ul style="list-style-type: none"> • Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems. • Explain the idea of analyticity, potential fields residues and poles of complex potentials in field theory and electromagnetic theory. • Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction. • Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems. • Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Text Books:				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books:				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7 th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	2006
5	Higher Engineerig Mathematics	H. K. Dass and Er. Rajnish Verma	S.Chand publishing	First Edition, 2011
Web links and Video Lectures				
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - IV			
POWER GENERATION AND ECONOMICS(Core Subject)			
Subject Code	15EE42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Explain the arrangement and operation of hydroelectric, steam, diesel, gas turbine and nuclear power plants and working of major equipment in the plants. • Classification of substation and explain the operation of different substation equipment. • Explain the importance of grounding and different grounding methods used in practice. • Explain the economics of power generation and importance of power factor. 			
Module-1			Teaching Hours
Hydroelectric Power Plants: Hydrology, run off and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the plants based on water flow regulation, water head and type of load the plant has to supply. Water turbines – Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines Governing of turbines, selection of water turbines. Underground, small hydro and pumped storage plants. Choice of size and number of units, plant layout and auxiliaries. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Steam Power Plants: Introduction, Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries. Diesel Power Plant: Introduction, Merits and demerits, selection site, elements of diesel power plant, applications. Gas Turbine Power Plant: Introduction, Merits and demerits, selection site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple steam power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam and diesel power plants. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Nuclear Power Plants: Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Substations: Introduction to Substation equipment; Transformers, High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches, Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments, and power line carrier communication equipment. Classification of substations – indoor and outdoor, Selection of site for substation, Busbar arrangement schemes and single line diagrams of substations.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
15EE42 POWER GENERATION AND ECONOMICS(Core Subject) (continued)				
Module-4 (continued)				Teaching Hours
Substations (continued): Interconnection of power stations. Introduction to gas insulated substation, Advantages and economics of Gas insulated substation. Grounding: Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded, solid grounding, resistance grounding, reactance grounding, resonant grounding. Earthing transformer. Neutral grounding and neutral grounding transformer. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Economics: Introduction, Effect of variable load on power system, classification of costs, Cost analysis. Interest and Depreciation, Methods of determination of depreciation, Economics of Power generation, different terms considered for power plants and their significance, load sharing. Choice of size and number of generating plants. Tariffs, objective, factors affecting the tariff, types. Types of consumers and their tariff. Power factor, disadvantages, causes, methods of improving power factor, Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor. Choice of equipment. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants. • Classify various substations and explain the importance of grounding. • Understand the economic aspects of power system operation and its effects. • Explain the importance of power factor improvement. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem analysis, Engineers and Society, Environment and Sustainability.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module.■ 				
Text/Reference Books				
1	A Course in Power Systems	J.B. Gupta	Katson	2008
2	Generation of Electrical Energy	B.R.Gupta	S. Chand	2015
3	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
4	Power Plant Engineering	P.K. Nag	McGrawHill	4 th Edition, 2014
5	Electrical Power Distribution Systems	V. Kamaraju	McGrawHill	1 st Edition, 2009
6	Electrical Distribution Engineering	Anthony J. Pansini	CRC Press	3 rd Edition, 2006
7	Electrical Distribution Systems	Dale R PatrickEt al	CRC Press	2 nd Edition, 2009
8	A Text Book on Power System Engineering	A.Chakrabarti, et al	DhanpathRai	2 nd Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV TRANSMISSION AND DISTRIBUTION (Core Subject)			
Subject Code	15EE43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the concepts of various methods of generation of power. • To understand the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • To design insulators for a given voltage level. • To calculate the parameters of the transmission line for different configurations and assess the performance of the line. • To study underground cables for power transmission and evaluate different types of distribution systems. 			
Module-1			Teaching Hours
<p>Introduction to power system: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.</p> <p>Overhead transmission lines: A brief introduction to types of supporting structures and line conductors-Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All –aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI),Super thermal resistant aluminium alloy (ZTAI), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), Gap type super thermal resistant aluminium alloy conductor steel reinforced (GZTACSR). Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightning; ground wires.</p> <p>Overhead line Insulators: A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Line parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
<p>Performance of transmission lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal π circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
<p>Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.</p>			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE43 TRANSMISSION AND DISTRIBUTION (Core Subject) (continued)				
Module-4 (continued)				Teaching Hours
Underground cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and dc cables. Limitations of cables. Specification of power cables. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated and uniform loads. Effect of disconnection of neutral in a 3 phase four wire system. Reliability and Quality of Distribution system: Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the concepts of various methods of generation of power. • Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • Design and analyze overhead transmission system for a given voltage level. • Calculate the parameters of the transmission line for different configurations and assess the performance of line. • Explain the use of underground cables and evaluate different types of distribution systems. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design / development of solutions, Engineers and society, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	A Course in Electrical Power	Soni Gupta and Bhatnagar	Dhanpat Rai	-
2	Power System Analysis and Design	J. Duncan Glover et al	Cengage Learning	4th Edition 2008
3	Principles of Power System	V.K. Mehta, Rohit Mehta	S. Chand	1 st Edition 2013
4	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
5	Electrical Power	S.L. Uppal	Khanna Publication	
6	Electrical power systems	C. L. Wadhwa	New Age	5 th Edition, 2009
7	Electrical power systems	Ashfaq Hussain	CBS Publication	
8	Electric Power Distribution	A.S. Pabla	McGraw-Hill	6 th Edition, 2012
9	For High temperature conductors refer www.jpowers.co.jp/english/product/pdf/gap_c1.pdf and Power System Analysis and Design, J. Duncan Glover et al			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV			
ELECTRIC MOTORS (Core Subject)			
Subject Code	15EE44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study the constructional features of Motors and select a suitable drive for specific application. • To study the constructional features of Three Phase and Single phase induction Motors. • To study different test to be conducted for the assessment of the performance characteristics of motors. • To study the speed control of motor by a different methods. • Explain the construction and operation of Synchronous motor and special motors. 			
Module-1			Teaching Hours
DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. Losses and efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Testing of dc motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests. Three phase Induction motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Performance of three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator; standalone operation and grid connected operation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods Single-phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Synchronous motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE44 ELECTRIC MOTORS (Core Subject) (continued)				
Module-5 (continued)				Teaching Hours
Other motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor and stepper motors. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the constructional features of Motors and select a suitable drive for specific application. • Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method. • Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance. • Control the speed of induction motor by a suitable method. • Explain the operation of Synchronous motor and special motors. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Electric Machines	D. P. Kothari, I. J. Nagrath	McGraw Hill	4th edition, 2011
2	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2nd Edition, 2013
3	Electric Machines	R.K. Srivastava	Cengage Learning	2nd Edition, 2013
4	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
5	Electrical Machines	M.V. Deshpande	PHI Learning	2013
6	Electric Machinery and Transformers	Bhag S Guru at el	Oxford University Press	3 rd Edition, 2012
7	Electric Machinery and Transformers	Irving Kosow	Pearson	2nd Edition, 2012
8	Theory of Alternating Current Machines	Alexander Langsdorf	McGraw Hill	2nd Edition, 2001

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV			
ELECTROMAGNETIC FIELD THEORY (Core Subject)			
Subject Code	15EE45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study different coordinate systems for understanding the concept of gradient, divergence and curl of a vector. • To study the application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations. • To evaluate the energy and potential due to a system of charges. • To study the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • To study the magnetic fields and magnetic materials. • To study the time varying fields and propagation of waves in different media. 			
Module-1			Teaching Hours
<p>Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Problems.</p> <p>Electrostatics: Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
<p>Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Problems.</p> <p>Conductor and Dielectrics: Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Capacitance of two wire line. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
<p>Poisson's and Laplace equations: Derivations and problems, Uniqueness theorem.</p> <p>Steady magnetic fields: Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-4			
<p>Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Problems.</p> <p>Magnetic materials and magnetism: Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE45 ELECTROMAGNETIC FIELD THEORY (Core Subject) (continued)				
Module-5				Teaching Hours
Time varying fields and Maxwell's equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Problems. Uniform plane wave: Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Problems. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector. • Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations. • Calculate the energy and potential due to a system of charges. • Explain the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • Explain the behavior of magnetic fields and magnetic materials. • Assess time varying fields and propagation of waves in different media. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Engineering Electromagnetics	William H Hayt et al	McGraw Hill	8 th Edition, 2014
2	Principles of Electromagnetics	Matthew N. O. Sadiku	Oxford	6 th Edition, 2015
3	Fundamentals of Engineering Electromagnetics	David K. Cheng	Pearson	2014
4	Electromagnetism -Theory (Volume -1) -Applications (Volume-2)	Ashutosh Pramanik	PHI Learning	2014
5	Electromagnetic Field Theory Fundamentals	Bhag Guru et al	Cambridge	2005
6	Electromagnetic Field Theory	Rohit Khurana	Vikas Publishing	1 st Edition, 2014
7	Electromagnetics	J. A. Edminister	McGraw Hill	3 rd Edition, 2010
8	Electromagnetic Field Theory and Transmission Lines	Gottapu Sasibhushana Rao	Wiley	1 st Edition, 2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV			
OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course)			
Subject Code	15EE46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the basics of Linear ICs such as Op-amp, Regulator, Timer & PLL. • To learn the designing of various circuits using linear ICs. • To use these linear ICs for specific applications. • To understand the concept and various types of converters. • To use these ICs, in Hardware projects. 			
Module-1			Teaching Hours
Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback ; voltage series feedback amplifier-gain, input resistance, output resistance, voltage shunt feedback amplifier- gain, input resistance, output resistance. General Linear Applications: D.C. & A.C amplifiers, peaking amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, differential configuration, instrumentation amplifier. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Active Filters: First & Second order high pass & low pass Butterworth filters, higher order filters Band pass filters, Band reject filters & all pass filters. DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Signal generators: Triangular / rectangular wave generator, phase shift oscillator, Wien bridge oscillator, oscillator amplitude stabilization, signal generator output controls. Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Signal processing circuits: Precision half wave & full wave rectifiers limiting circuits, clamping circuits, peak detectors, sample & hold circuits. A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC, dual slope ADC, digital ramp ADC. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Phase Locked Loop (PLL): Basic PLL, components, performance factors, applications of PLL IC 565. Timer: Internal architecture of 555 timer, Mono stable, Astable multivibrators and applications. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS)			

SEMESTER -IV				
15EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course) (continued)				
Course Outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the basics of linear ICs. • Design circuits using linear ICs. • Demonstrate the application of Linear ICs. • Use ICs in the electronic projects. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Design / development of solutions, Conduct investigations of complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Op-Amps and Linear Integrated Circuits	Ramakant A Gayakwad	Pearson	4 th Edition 2015
2	Operational Amplifiers and Linear ICs	David A. Bell	Oxford	3 rd Edition 2011
3	Linear Integrated Circuits; Analysis, Design and Applications	B. Somanthan Nair	Wiley India	2013
4	Linear Integrated Circuits	S. Salivahanan, et al	McGraw Hill	2 nd Edition, 2014
5	Operational Amplifiers and Linear Integrated Circuits	K. Lal Kishore	Pearson	1 st Edition, 2012
6	Linear Integrated Circuits	Muhammad H Rashid	Cengage Learning	1 st Edition, 2014
7	Op-Amps and Linear Integrated Circuits, Concept and Application	James M Fiore	Cengage	2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
ELECTRICAL MACHINES LABORATORY -2			
Subject Code	15EEL47	IA Marks	20
Number of PracticalHours/Week	03	Exam Hours	03
Total Number of PracticalHours	42	Exam Marks	80
Credits - 02			
Course Objectives:			
<ul style="list-style-type: none"> • To perform tests on dc machines to determine their characteristics. • To control the speed of dc motor. • To conduct test for pre-determination of the performance characteristics of dc machines • To conduct load test on single phase and three phase induction motor. • To conduct test on induction motor to determine the performance characteristics. • To conduct test on synchronous motor to draw the performance curves. ■ 			
Sl. No	Experiments		
1	Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.		
2	Field Test on dc series machines.		
3	Speed control of dc shunt motor by armature and field control.		
4	Swinburne's Test on dc motor.		
5	Retardation test on dc shunt motor.		
6	Regenerative test on dc shunt machines.		
7	Load test on three phase induction motor.		
8	No - load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).		
9	Load test on induction generator.		
10	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.		
11	Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.		
12	Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load conditions.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Test dc machines to determine their characteristics. • Control the speed of dc motor. • Pre-determine the performance characteristics of dc machines by conducting suitable tests. • Perform load test on single phase and three phase induction motor to assess its performance. • Conduct test on induction motor to pre-determine the performance characteristics. • Conduct test on synchronous motor to draw the performance curves. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
OP- AMP AND LINEAR ICS LABORATORY			
Subject Code	15EEL48	IA Marks	20
Number of PracticalHours/Week	03	Exam Hours	03
Total Number of PracticalHours	42	Exam Marks	80
Credits - 02			
Course Objectives:			
<ul style="list-style-type: none"> • To conduct different experiments using OP-Amps • To conduct experiments using Linear IC's 			
<p>a) Study of pin details, specifications, application features of IC741 (LM741) and IC555 (Timer) through corresponding datasheets (Datasheets are instruction manuals for electronic components. They explain exactly what a component does and how to use it.).</p> <p>b) Comparison of output performance quantity of an Operational Amplifier obtained by rigging up the circuit with the ideal value of</p> <p>(i) A Non – Inverting Amplifier ($V_{out} = AV_{in}$) (ii) An Inverting Amplifier ($V_{out} = -AV_{in}$) (iii) A Difference Amplifier ($V_{out} = -A(V_p - V_n)$) (iv) A Difference Amplifier with floating inputs ($V_{out} = AV_{in}$) (v) A Non – Inverting Amplifier with negative feedback (ii) An Inverting Amplifier with negative feedback (vi) A Differential Amplifier with a negative feedback (vii) A Differential Amplifier with negative feedback and equalised amplifications.</p> <p>(viii) A Voltage follower (ix) A differential – in differential –out amplifier (x) An instrumentation amplifier</p> <p>c) Plot of input and output transfer characteristics to analyse and conclude that op-amps are rarely used in open-loop.</p> <p>d) Testing of op – amp.</p>			To be covered in 03 Laboratory classes.
Sl. No	Experiments		
1	Design and verify a precision full wave rectifier. Determine the performance parameters.		
2	Design and realize to analyse the frequency response of an op – amp amplifier under inverting and non - inverting configuration for a given gain.		
3	Design and verify the output waveform of an op – amp RC phase shift oscillator for a desired frequency.		
4	Design and realize Schmitt trigger circuit using an op – amp for desired upper trip point (UTP) and lower trip point (LTP).		
5	Verify the operation of an op – amp as (a) voltage comparator circuit and (b) zero crossing detector.		
6	Design and verify the operation of op – amp as an (a) adder (b) subtractor (c) integrator and (d) differentiator.		
7	Design and realize an op – amp based first order Butterworth (a) low pass (b) high pass and (c) band pass filters for a given cut off frequency/frequencies to verify the frequency response characteristic.		
8	Design and realize an op – amp based function generator to generate sine, square and triangular waves of desired frequency.		
9	Design and realization of R-2R ladder DAC.		
10	Realization of Two bit Flash ADC		
11	Design and verify an IC 555 timer based pulse generator for the specified pulse.		
12	Designing of Fixed voltage power supply (voltage regulator) using IC regulators 78 series and 79 series.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • To conduct experiment to determine the characteristic parameters of OP-Amp • To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV
15EEL48 OP- AMP AND LINEAR ICS LABORATORY (continued)
Course Outcomes (continued): <ul style="list-style-type: none">• To design test the OP-Amp as oscillators and filters• Design and study of Linear IC's as multivibrator power supplies.
Graduate Attributes (As per NBA) Engineering Knowledge, Individual and Team work, Communication.
Conduct of Practical Examination: <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

**** END ****

V SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
MANAGEMENT AND ENTREPRENEURSHIP (Core Course)			
Subject Code	15EE51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process. • To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff, the social responsibility of business and leadership. • To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship. • To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs • To discuss the importance of Small Scale Industries and the related terms and problems involved. • To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan. • To introduce the concepts of project management and discuss capital building process. • To explain project feasibility study and project appraisal and discuss project financing • To discuss about different institutions at state and central levels supporting business enterprises. ■ 			
Module-1			Teaching Hours
Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession. Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment. Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V	
15EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)	
Module-4	Teaching Hours
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions. ■</p>	10
<p>Revised Bloom's Taxonomy Level</p>	L ₃ – Applying.
Module-5	
<p>Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.</p> <p>New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM . ■</p>	10
<p>Revised Bloom's Taxonomy Level</p>	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process. • Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff in exercising the authority and delegating duties. • To explain the social responsibility of business and leadership • Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development. • Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation. • Discuss the concepts of project management, capitol building process, project feasibility study, project appraisal and project financing. • Discuss the state /central level institutions / agencies supporting business enterprises. ■ 	
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)				
Textbooks				
1	Principles of Management	P.C.Tripathi, P.N.Reddy	McGraw Hill,	6 th Edition, 2017
2	Entrepreneurship Development And Small Business Enterprises	Poornima M.Charanthimath	Pearson	2 nd Edition,2014
Reference Books				
1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership perspective	Harold Koontz, Heinz Weihrich	McGraw Hill	10 th Edition 2016

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
MICROCONTROLLER (Core Course)			
Subject Code	15EE52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain the internal organization and working of Computers, microcontrollers and embedded processors. • Compare and contrast the various members of the 8051 family. • To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions. • To explain in detail the execution of 8051 Assembly language instructions and data types • To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions. • To explain different addressing modes of 8051, arithmetic, logic instructions, and programs. • To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic, arithmetic operations and data conversion. ■ 			
Module-1			Teaching Hours
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
8051 programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C 8051 Timer programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
8051 serial port programming in assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. 8051 Interrupt programming in assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE52 MICROCONTROLLER (Core Course) (continued)				
Module-5				Teaching Hours
Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and sensor interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. Motor control: Relay, PWM, DC and stepper motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM. 8051 interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255. ■				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051. • Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions. • Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs. • Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization • Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051 to the RS232. • Discuss in detail 8051 interrupts and writing interrupt handler programs. • Interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors. • Interface 8031/51 with external memories, 8255 chip to add ports and relays, opt isolators and motors. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2 nd Edition, 2008.
Reference Books				
1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3 rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1 st Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
POWER ELECTRONICS (Core Course)			
Subject Code	15EE53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics. • To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits. • To explain the techniques for design and analysis of single phase diode rectifier circuits. • To explain different power transistors, their steady state and switching characteristics and imitations. • To explain different types of Thyristors, their gate characteristics and gate control requirements. • To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■ 			
Module-1			Teaching Hours
Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches. Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Diode Switched <i>RL</i> Load, Freewheeling Diodes with Switched <i>RL</i> Load. Diode Rectifiers: Introduction, Single-Phase Full-Wave Rectifiers, Single-Phase Full-Wave Rectifier with <i>RL</i> Load, Single-Phase Full-Wave Rectifier with a Highly Inductive Load. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-2			
Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-3			
Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, <i>di/dt</i> Protection, <i>dv/dt</i> Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-4			
Controlled Rectifiers: Introduction, Single-Phase Full Converters, Single-Phase Dual Converters, Three-Phase Full Converters, Three-Phase Dual Converters, AC Voltage Controllers: Introduction, Single-Phase Full-Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE53 POWER ELECTRONICS (Core Course) (continued)				
Module-5				Teaching Hours
DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification. DC-AC converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain application area of power electronics, types of power electronic circuits and switches their characteristics and specifications. • Explain types of power diodes, their characteristics, and the effects of power diodes on RL circuits. • Explain the techniques for design, operation and analysis of single phase diode rectifier circuits. • Explain steady state, switching characteristics and gate control requirements of different power transistors and their limitations. • Discuss different types of Thyristors, their operation, gate characteristics and gate control requirements. • Explain designing, analysis techniques and characteristics of thyristor controlled rectifiers. • Discuss the principle of operation of single phase and three phase DC - DC, DC –AC converters and AC voltage controllers. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014
Reference Books				
1	Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
2	Power Electronics	Daniel W Hart	McGraw Hill	1 st Edition, 2011
3	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V			
SIGNALS AND SYSTEMS (Core Course)			
Subject Code	15EE54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss arising of signals in different systems. • To classify the signals and define certain elementary signals. • To explain basic operations on signals and properties of systems. • To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains. • To explain the properties of linear time invariant systems in terms of impulse response description. • To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it. • To explain Fourier transform representation of continuous time and discrete time non –periodic signals and the properties of Fourier Transforms. • To explain the applications of Fourier transform representation to study signals and linear time invariant systems. • To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■ 			
Module-1			Teaching Hours
Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L – 4 Analysing, L ₅ – Evaluating.		
Module-2			
Time – Domain Representations For LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of differential equations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating..		
Module-5			
Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE54 SIGNALS AND SYSTEMS (Core Subject) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Classify the signals and systems. • Explain basic operations on signals and properties of systems. • Use convolution in both continuous and discrete domain for the analysis of systems given the impulse response of a system. • Evaluate response of a given linear time invariant system. • Provide block diagram representation of a linear time invariant system. • Apply continuous time Fourier transform representation to study signals and linear time invariant systems. • Apply discrete time Fourier transform representation to study signals and linear time invariant systems. Use Z-transform and properties of Z transform for the analysis of discrete time systems. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2 nd Edition,2002
Reference Books				
2	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2 nd Edition 2010
3	Signals and Systems	NagoorKani	McGraw Hill	1 st Edition 2010
4	Signals and Systems A Primer with MATLAB	Matthew N.O. Sadiku Warsame H. Ali	CRC Press	1 st Edition, 2016
5	Signals and Systems	Anand Kumar	PHI	3 rd Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V			
ELECTRICAL ENGINEERING MATERIALS (Professional Elective)			
Subject Code	15EE552	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits – 03			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications. • To impart the knowledge of superconducting materials and their applications • To impart the knowledge of plastics and materials for Opto - Electronic devices. ■ 			
Module-1			Teaching Hours
<p>Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.</p> <p>Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems . ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Conductive Materials and Applications: Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.</p> <p>Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behaviour of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.</p> <p>Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
<p>Magnetic Materials (continued):Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.</p> <p>Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field</p>			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE552 ELECTRICAL ENGINEERING MATERIALS (Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Superconductive Materials (continued): and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London's theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic. Materials for Opto – Electronic Devices: Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electrical and electronics materials, their importance, classification and operational requirement • Discuss conducting materials used in engineering, their properties and classification. • Discuss dielectric materials used in engineering, their properties and classification. • Discuss insulating materials used in engineering, their properties and classification. • Discuss magnetic materials used in engineering, their properties and classification • Explain the phenomenon superconductivity, super conducting materials and their application in engineering. • Explain the plastic and its properties and applications. • Discuss materials used for Opto electronic devices. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Advanced Electrical and Electronics Materials; Processes and Applications	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015
Reference Books				
1	Electronic Engineering Materials	R.K. Shukla Archana Singh	McGraw Hill	2012
2	Electrical Properties of Materials	L Solymer et al	Oxford	9 th Edition, 2014
3	Electrical Engineering Materials	A.J. Dekker	Pearson	2016
4	Principle of Electronic Materials and Devices	S.O. Kasap	McGraw Hill	3 rd Edition 2010

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V			
PROGRAMMABLE LOGIC CONTROLLERS (Open Elective)			
Subject Code	15EE562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC. • To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map. • To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction. • To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs. • To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays. • To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions. • To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems. • To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction. • To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions. • To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations. • To describe the operation of bit and word shift registers and develop programs that use shift registers. • To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ■ 			
Module-1			Teaching Hours
<p>Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.</p> <p>PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).</p> <p>Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,		
Module-2			
<p>Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.</p> <p>Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V	
15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)	
Module-3	Teaching Hours
<p>Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.</p> <p>Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.
Module-4	
<p>Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.</p> <p>Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.
Module-5	
<p>Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.</p> <p>Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions. • Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming. • Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module. • Convert relay schematics and narrative descriptions into PLC ladder logic programs • Analyze PLC timer and counter ladder logic programs • Describe the operation of different program control instructions • Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system. • Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■ 	
Graduate Attributes (As per NBA)	
Engineering Knowledge	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. <p>Students will have to answer 5 full questions, selecting one full question from each module. ■</p>	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)				
CHOICE BASED CREDIT SYSTEM (CBCS)				
SEMESTER - V				
15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)				
Textbook				
1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill,	4 th Edition, 2011
Reference Book				
1	Programmable Logic Controllers an Engineer's Guide,	E A Parr	Newnes	3 rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3 rd Edition, 2006

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V RENEWABLE ENERGY RESOURCES(Open Elective)			
Subject Code	15EE563	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. • To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships • To discuss about solar energy reaching the Earth’s surface and solar thermal energy applications. • To discuss types of solar collectors, their configurations and their applications • To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications. • To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages. • To discuss wind turbines, wind resources, site selection for wind turbine • To discuss geothermal systems, their classification and geothermal based electric power generation • To discuss waste recovery management systems, advantages and disadvantages • To discuss biomass production, types of biomass gasifiers, properties of producer gas. • To discuss biogas, its composition, production, benefits. • To discuss tidal energy resources, energy availability, power generation. • To explain motion in the sea wave, power associated with sea wave and energy availability and the devices for harnessing wave energy. • To discuss principles of ocean thermal energy conversion and production of electricity. ■ 			
Module-1			Teaching Hours
Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India. Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth’s Surface, Solar Thermal Energy Applications. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond. Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy. Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection. Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V	
15EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)	
Module-3 (continued)	Teaching Hours
Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.
Module-4	
Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.	
Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.	
Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.
Module-5	
Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.	
Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.
Course outcomes: At the end of the course the student will be able to:	
<ul style="list-style-type: none"> • Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. • Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy applications. • Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications. • Discuss generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse. • Discuss production of energy from biomass, biogas. • Discuss tidal energy resources, energy availability and power generation. • Discuss power generation sea wave energy and ocean thermal energy. ■ 	
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.	
Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. 	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
15EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)				
Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1 st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3 rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3 rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1 st Edition, 2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -V			
MICROCONTROLLER LABORATORY - 1			
Subject Code	15EEL57	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions. • To explain writing assembly language programs for code conversions. • To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers. • To perform interfacing of stepper motor and dc motor for controlling the speed. • To explain generation of different waveforms using DAC interface. ■ 			
Sl. NO	Experiments		
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.			
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.		
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for 16 bit numbers.		
3	Counters		
4	Boolean and logical instructions (bit manipulation).		
5	Conditional call and return instructions.		
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa decimal to and Decimal to Hexa.		
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.		
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.			
8	Stepper motor interface.		
9	DC motor interface for direction and speed control using PWM.		
10	Alphanumerical LCD panel interface.		
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.		
12	External ADC and Temperature control interface.		
13	Elevator interface.		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions. • Write ALP for code conversions. • Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers. • Perform interfacing of stepper motor and dc motor for controlling the speed. • Generate different waveforms using DAC interface. • Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.			

<p style="text-align: center;">B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -V</p>
<p style="text-align: center;">15EEL57 MICROCONTROLLER LABORATORY – 1(continued)</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■
<p>Learning beyond the syllabus: To acquire a wide variety of skills and to develop society friendly applications mini projects can be practiced by referring to “Microcontroller Based Projects” Second Edition, An EFY (Electronics For You) Enterprise Pvt Ltd, 2013.</p>

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - V			
POWER ELECTRONICS LABORATORY			
Subject Code	15EEL58	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments on semiconductor devices to obtain their static characteristics. • To study different methods of triggering the SCR • To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • To control the speed of a dc motor, universal motor and stepper motors. • To study single phase full bridge inverter connected to resistive load. • To study commutation of SCR. ■ 			
Sl. No	Experiments		
1	Static Characteristics of SCR.		
2	Static Characteristics of MOSFET and IGBT.		
3	Characteristic of TRIAC.		
4	SCR turn on circuit using synchronized UJT relaxation oscillator.		
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.		
6	Single phase controlled full wave rectifier with R and R –L loads.		
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.		
8	Speed control of dc motor using single semi converter.		
9	Speed control of stepper motor.		
10	Speed control of universal motor using ac voltage regulator.		
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.		
12	Design of Snubber circuit.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Obtain static characteristics of semiconductor devices to discuss their performance. • Trigger the SCR by different methods • Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • Control the speed of a dc motor, universal motor and stepper motors. • Verify the performance of single phase full bridge inverter connected to resistive load. • Perform commutation of SCR by different methods. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

VI SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI			
CONTROL SYSTEMS (Core Subject)			
Subject Code	15EE61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define a control system • To explain the necessity of feedback and types of feedback control systems. • To introduce the concept of transfer function and its application to the modeling of linear systems. • To demonstrate mathematical modeling of control systems. • To obtain transfer function of systems through block diagram manipulation and reduction • To use Mason's gain formula for finding transfer function of a system • To discuss transient and steady state time response of a simple control system. • To discuss the stability of linear time invariant systems and Routh - Hurwitz criterion • To investigate the trajectories of the roots of the characteristic equation when a system parameter is varied. • To conduct the control system analysis in the frequency domain. • To analyze stability of a control system using Nyquist plot. • To discuss stability analysis using Bode plots. • To determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications. ■ 			
Module-1			Teaching Hours
Introduction to control systems: Introduction, classification of control systems. Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Block diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function. Signal flow graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants, types of control systems. Routh Stability criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Root locus technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus. Frequency Response analysis: Co-relation between time and frequency response – 2 nd order systems only. Bode plots: Basic factors $G(i\omega)/H(j\omega)$, General procedure for constructing bode plots, computation of gain margin and phase margin. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
15EE61 CONTROL SYSTEMS (Core Subject) (continued)				
Module-5				Teaching Hours
<p>Nyquist plot: Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.</p> <p>Design of Control Systems: Introduction, Design with the PD Controller, Design with the PI Controller, Design with the PID Controller, Design with Phase-Lead Controller, Design with Phase - Lag Controller, Design with Lead-Lag Controller. ■</p>				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss the effects of feedback and types of feedback control systems. • Evaluate the transfer function of a linear time invariant system. • Evaluate the stability of linear time invariant systems. • Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems. • Demonstrate the knowledge of mathematical modeling of control systems and components • Determine transient and steady state time response of a simple control system. • Investigate the performance of a given system in time and frequency domains. • Discuss stability analysis using Root locus, Bode plots and Nyquist plots. • Determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications. 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Modern Tool Usage, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Control Systems	Anand Kumar	PHI	2 nd Edition, 2014
ReferenceBooks				
1	Automatic Control Systems	FaridGolnaraghi, Benjamin C. Kuo	Wiley	9 th Edition, 2010
2	Control Systems Engineering	Norman S. Nise	Wiley	4 th Edition, 2004
3	Modern Control Systems	Richard C Dorf et al	Pearson	11 th Edition, 2008
4	Control Systems, Principles and Design	M.Gopal	McGaw Hill	4 th Edition, 2012
5	Control Systems Engineering	S. Salivahanan et al	Pearson	1 st Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
POWER SYSTEM ANALYSIS – 1 (Core Subject)			
Subject Code	15EE62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the per unit system and explain its advantages and computation. • To explain the concept of one line diagram and its implementation in problems. • To explain the necessity and conduction of short circuit analysis. • To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems. • To discuss selection of circuit breaker. • To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits. • To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits. • To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines. • To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. • To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine • Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system. ■ 			
Module-1			Teaching Hours
Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of electrical Power, Representation of Loads. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System, Measurement of sequence Impedance of Synchronous Generator. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE62 POWER SYSTEM ANALYSIS – 1 (Core Subject) (continued)				
Module-5				Teaching Hours
Power System Stability: Introduction, Dynamics of a Synchronous Machine, Power Angle Equation Salient and Non – Salient pole Synchronous Machines, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability. ■				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Show understanding of per unit system, its advantages and computation. • Show the concept of one line diagram and its implementation in problems • Perform short circuit analysis on a synchronous machine and simple power system to select a circuit breaker for the system. • Evaluate symmetrical components of voltages and currents in un-balanced three phase circuits. • Explain the concept of sequence impedance and sequence networks of power system components and power system. • Analyze three phase synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. • Discuss the dynamics of synchronous machine, stability and types of stability. • Discuss equal area criterion for the evaluation of stability of a simple system under different fault conditions. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, The Engineer and Society, Ethics				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1.	Modern Power System	D. P. Kothari	McGraw Hill	4 th Edition, 2011
ReferenceBooks				
1	Elements of Power System	William D. Stevenson Jr	McGraw Hill	4 th Edition, 1982
2	Power System Analysis and Design	J.Duncan Glover et al	Cengage	4 th Edition, 2008
3	Power System Analysis	Hadi Sadat	McGraw Hill	1 st Edition, 2002

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
DIGITAL SIGNAL PROCESSING (Core Subject)			
Subject Code	15EE63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define Discrete Fourier transform and its properties. • To evaluate DFT of various signals using properties of DFT. • To explain different linear filtering techniques. • To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms • To discuss impulse invariant transformation, bilinear transformation techniques and their properties. • To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques. • To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques. • To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter. • To discuss window functions used for the design of FIR filters. • To discuss windowing technique of designing FIR filter. • To discuss frequency sampling technique of designing FIR filter. • To discuss direct, cascade and linear phase form of realizing a digital FIR filter. ■ 			
Module-1			Teaching Hours
Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham’s method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-2			
Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-3			
Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-4			
Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type I filter by impulse invariant transformation and bilinear transformation, Frequency transformations. Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE63 DIGITAL SIGNAL PROCESSING (Core Subject) (continued)				
Module-5				Teaching Hours
Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, design of FIR digital filters by use of windows, Design of FIR digital filters -frequency sampling techniques. Realization of FIR systems: direct form, cascade form, linear phase form ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Compute the DFT of various signals using its properties and linear filtering of two sequences. • Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence • Design infinite impulse response Butterworth digital filters using impulse invariant / bilinear transformation technique. • Design infinite impulse response Chebyshev digital filters using impulse invariant or bilinear transformation technique. • Realize a digital IIR filter by direct, cascade, parallel and ladder methods of realization. • Discuss different window functions and frequency sampling method used for design of FIR filters. • Design FIR filters by use of window function or by frequency sampling method. • Realize a digital FIR filter by direct, cascade, and linear phase form. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Design/ Development of Solutions, Modern Tool Usage.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson	1 st Edition, 2016
Reference Books				
1.	Digital Signal Processing – Principles, Algorithms, and Applications	Jhon G. Proakis Dimitris G. Manolakis	Pearson	4 th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill	2 nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley	2 nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage	1 st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford	1 st Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
ELECTRICAL MACHINE DESIGN (Core Course)			
Subject Code	15EE64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines. • To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines. • To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines. • To discuss the selection of specific loadings, for various machines. • To discuss separation of main dimensions for different electrical machines • To discuss design of field windings for DC machines and synchronous machines. • To evaluate the performance parameters of transformer, induction motor. • To design of cooling tubes for the transformer for a given temperature rise. • To explain design of rotor of squirrel cage rotor and slip ring rotor. • To define short circuit ratio and discuss its effect on machine performance. ■ 			
Module-1			Teaching Hours
Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques. Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE64 ELECTRICAL MACHINE DESIGN (Core Course) (continued)				
Module-5				
Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding. ■				10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss design factors, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines. • Derive the output equations of transformer, DC machines and AC machines. • Discuss selection of specific loadings and magnetic circuits of different electrical machines • Design the field windings of DC machine and Synchronous machine. • Design stator and rotor circuits of a DC and AC machines. • Estimate the number of cooling tubes, no load current and leakage reactance of core type transformer. • Discuss short circuit ratio and its effects on performance of synchronous machines. • Design salient pole and non-salient pole alternators for given specifications. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	A course in Electrical Machine design	A.K.Sawhney	DhanpatRai	6 th Edition, 2013
Reference Books				
1	Performance and Design of Alternating Current Machines	M.G. Say	CBS Publisher	3 rd Edition, 2002
2	Design Data Handbook	A. Sanmugasundaram Et al	New Age International	1 st Edition, 2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI COMPUTER AIDED ELECTRICAL DRAWING (Professional Elective)			
Subject Code	15EE651	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss the terminology of DC and AC armature windings. • To discuss design and procedure to draw armature winding diagrams for DC and AC machines. • To discuss the substation equipment, their location in a substation and development of a layout for substation. • To discuss different sectional views of transformers, DC machine, its parts and alternator and its parts. • To explain development of sectional views of Transformers, DC machine and alternators using the design data, sketches. ■ 			
Suitable CAD software can be used for drawings			
PART - A			
Module-1			Teaching Hours
Winding Diagrams: (a) Developed Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings. (b) Developed Winding Diagrams of A.C. Machines: (c) Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings. (d) Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Single Line Diagrams: Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power-Line Carrier) and Line Trap. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
PART - B			
Module-3			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Alternator – Sectional Views of Stator and Rotor dealt separately. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
15EE651 COMPUTER AIDED ELECTRICAL DRAWING (Professional Elective) (continued)				
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss the terminology and types of DC and AC armature windings. • Develop armature winding diagram for DC and AC machines • Develop a layout for substation using the standard symbols for substation equipment. . • Draw sectional views of core and shell types transformers using the design data • Draw sectional views of assembled DC machine or its parts using the design data or the sketches. • Draw sectional views of assembled alternator or its parts using the design data or the sketches. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have two parts, PART – A and PART – B. • Each part is for 40 marks. • Part A is for Modules 1 and 2. • Questions 1 and 2 of PART - A will be only on DC windings or only on AC windings. Students have to answer any one of them. The marks prescribed is 25. • Question 3 of PART – A covering module 2 is compulsory. The marks prescribed is 15. • Part B is for Modules 3, 4 and 5. • Questions 4 and 5 will cover any two modules of modules 3, 4 and 5. Students have to answer any one of them. The marks prescribed is 40. ■ 				
Reference Books				
1	A course in Electrical Machine design	A. K. Sawhney	DhanpatRai	6 th Edition, 2013
2	Electrical Engineering Drawing	K. L. Narang	SatyaPrakashan	2014

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – VI			
SENSORS AND TRANSDUCERS(Open Elective)			
Subject Code	15EE662	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits – 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss need of transducers, their classification, advantages and disadvantages. • To discuss working of different types of transducers and sensors.. • To discuss recent trends in sensor technology and their selection. • To discuss basics of signal conditioning and signal conditioning equipment. • To discuss configuration of Data Acquisition System and data conversion. • To discuss the basics of Data transmission and telemetry. • To explain measurement of various non-electrical quantities.■ 			
Module-1			Teaching Hours
Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers. Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Data Transmission and Telemetry: Data/Signal Transmission, Telemetry. Measurement of Non – Electrical Quantities: Pressure Measurement ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – VI				
15EE662 SENSORS AND TRANSDUCERS(Open Elective) (continued)				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss need of transducers, their classification, advantages and disadvantages. • Show an understanding of working of various transducers and sensors. • Discuss recent trends in sensor technology and their selection. • Discuss basics of signal conditioning and signal conditioning equipment. • Discuss configuration of Data Acquisition System and data conversion. • Show knowledge of data transmission and telemetry. • Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3 rd Edition, 2013.
Reference Books				
1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13 th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -VI			
CONTROL SYSTEM LABORATORY			
Subject Code	15EEL67	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To determine the time and frequency domain responses of a given second order system using software package or discrete components. • To design and analyze Lead, Lag and Lead – Lag compensators for given specifications. • To draw the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair. • To simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system. • To write a script files to plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package. ■ 			
Sl. NO	Experiments		
1	Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor		
2	Experiment to draw synchro pair characteristics		
3	Experiment to determine frequency response of a second order system		
4	(a) To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lead compensating network.		
5	(a) To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lag compensating network		
6	Experiment to draw the frequency response characteristics of the lag – lead compensator network and determination of its transfer function.		
Experiments 7 to 11 must be done using MATLAB/SCILAB only.			
7	(a) To simulate a typical second order system and determine step response and evaluate time response specifications. (b) To evaluate the effect of additional poles and zeros on time response of second order system. (c) To evaluate the effect of pole location on stability (d) To evaluate the effect of loop gain of a negative feedback system on stability.		
8	To simulate a second order system and study the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.		
9	(a) To simulate a D.C. Position control system and obtain its step response. (b) To verify the effect of input waveform, loop gain and system type on steady state errors. (c) To perform trade-off study for lead compensator. (d) To design PI controller and study its effect on steady state error.		
10	(a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response (b) To study the effect of open loop gain on transient response of closed loop system using root locus.		
11	(a) To study the effect of open loop poles and zeros on root locus contour (b) To estimate the effect of open loop gain on the transient response of closed loop system using root locus. (c) Comparative study of Bode, Nyquist and root locus with respect to stability.		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -VI**

15EEL67 CONTROL SYSTEM LABORATORY(continued)

Course outcomes: At the end of the course the student will be able to:

- Use software package or discrete components in assessing the time and frequency domain responses of a given second order system.
- Design and analyze Lead, Lag and Lead – Lag compensators for given specifications.
- Determine the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair used in control systems.
- Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- Write a script files to plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package.
- Work with a small team to carryout experiments and prepare reports that present lab work. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI			
DIGITAL SIGNAL PROCESSING LABORATORY			
Subject Code	15EEL68	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain the use of MATLAB software in evaluating the DFT and IDFT of given sequence • To verify the convolution property of the DFT • To design and implementation of IIR and FIR filters for given frequency specifications. • To realize IIR and FIR filters. • To help the students in developing software skills. ■ 			
Sl. No	Experiments		
1	Verification of Sampling Theorem both in time and frequency domains		
2	Evaluation of impulse response of a system		
3	To perform linear convolution of given sequences		
4	To perform circular convolution of given sequences using (a) the convolution summation formula (b) the matrix method and (c) Linear convolution from circular convolution with zero padding.		
5	Computation of N – point DFT and to plot the magnitude and phase spectrum.		
6	Linear and circular convolution by DFT and IDFT method.		
7	Solution of a given difference equation.		
8	Calculation of DFT and IDFT by FFT		
9	Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters)		
10	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions		
11	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique.		
12	Realization of IIR and FIR filters		
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating,	
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Give physical interpretation of sampling theorem in time and frequency domains. • Evaluate the impulse response of a system. • Perform convolution of given sequences to evaluate the response of a system. • Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods. • Provide a solution for a given difference equation. • Design and implement IIR and FIR filters • Conduct experiments using software and prepare reports that present lab work ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

*** END ***

VII SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
POWER SYSTEM ANALYSIS – 2(Core Course)			
Subject Code	15EE71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain formulation of network models and bus admittance matrix for solving load flow problems. • To discuss solution of nonlinear static load flow equations by different numerical techniques and methods to control voltage profile. • To discuss optimal operation of generators on a bus bar, optimal unit commitment, reliability considerations and optimum generation scheduling. • To discuss optimal power flow solution, scheduling of hydro-thermal system, power system security and reliability. • To explain formulation of bus impedance matrix for the use in short circuit studies on power systems. • To explain numerical solution of swing equation for multi-machine stability. ■ 			
Module-1			Teaching Hours
Load Flow Studies: Introduction, Network Model Formulation, Formation of Y_{bus} by Singular Transformation, Load Flow Problem, Gauss-Seidel Method. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-2			
Load Flow Studies (continued): Newton-Raphson Method, Decoupled Load Flow Methods, Comparison of Load Flow Methods, Control of Voltage Profile. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-3			
Optimal System Operation: Introduction, Optimal Operation of Generators on a Bus Bar, Optimal Unit Commitment, Reliability Considerations, Optimum Generation Scheduling. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-4			
Optimal System Operation (continued): Optimal Load Flow Solution, Optimal Scheduling of Hydrothermal System, Power System Security, Maintenance Scheduling, Power System Reliability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-5			
Symmetrical Fault Analysis: Algorithm for Short Circuit Studies, Z_{bus} Formulation. Power System Stability: Numerical Solution of Swing Equation, Multimachine Stability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Formulate network matrices and models for solving load flow problems. • Perform steady state power flow analysis of power systems using numerical iterative techniques. • Suggest a method to control voltage profile. • Show knowledge of optimal operation of generators on a bus bar, optimal unit commitment, 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) 15EE71POWER SYSTEM ANALYSIS – 2(Core Subject) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Course outcomes(continued):				
<ul style="list-style-type: none"> • Discuss optimal scheduling for hydro-thermal system, power system security and reliability. • Analyze short circuit faults in power system networks using bus impedance matrix. • Perform numerical solution of swing equation for multi-machine stability■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Modern Power System Analysis	D. P. Kothari	McGraw Hill	4 th Edition, 2011
Reference Books				
1	Computer Methods in Power Systems Analysis	Glenn W Stagg Ahmed H Ei - Abiad	McGraw Hill	1stEdition, 1968
2	Computer Techniques in Power System Analysis	M.A. Pai	McGraw Hill	2ndEdition, 2006
3	Power System Analysis	HadiSaadat	McGraw Hill	2ndEdition, 2002

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
POWER SYSTEM PROTECTION(Core Subject)			
Subject Code	15EE72	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss performance of protective relays, components of protection scheme and relay terminology. • To explain relay construction and operating principles. • To explain Overcurrent protection using electromagnetic and static relays and Overcurrent protective schemes. • To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays. • To discuss pilot protection; wire pilot relaying and carrier pilot relaying. • To discuss construction, operating principles and performance of various differential relays for differential protection. • To discuss protection of generators, motors, Transformer and Bus Zone Protection. • To explain the principle of circuit interruption and different types of circuit breakers. • To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse. • To discuss protection Against Overvoltages and Gas Insulated Substation (GIS). ■ 			
Module-1			Teaching Hours
<p>Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.</p> <p>Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.</p> <p>Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Overcurrent Protection (continued): Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.</p> <p>Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges(Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection</p> <p>Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.</p> <p>Rotating Machines Protection: Introduction, Protection of Generators.</p> <p>Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE72 POWER SYSTEM PROTECTION (Core Course) (continued)				
Module-4				Teaching Hours
Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF ₆ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination. Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL). Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS). ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss performance of protective relays, components of protection scheme and relay terminology overcurrent protection. • Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays. • Discuss pilot protection; wire pilot relaying and carrier pilot relaying. • Discuss construction, operating principles and performance of differential relays for differential protection. • Discuss protection of generators, motors, Transformer and Bus Zone Protection. • Explain the principle of circuit interruption in different types of circuit breakers. • Describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse. • Discuss protection against Overvoltages and Gas Insulated Substation (GIS). ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Power System Protection and Switchgear	Badri Ram, D.N. Vishwakarma	McGraw Hill	2 nd Edition
2	Power System Protection and Switchgear (For additional study on gapless arrester, Refer to pages 458 to 461)	Bhuvanesh Oza et al	McGraw Hill	1 st Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE72 POWER SYSTEM PROTECTION (Core Course) (continued)				
Reference Books				
1	Protection and Switchgear	Bhavesht et al	Oxford	1 st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1 st Edition, 2009
3	Fundamentals of Power System Protection	Y.G.Paithankar S.R. Bhide	PHI	1 st Edition, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -VII			
HIGH VOLTAGE ENGINEERING (Core Course)			
Subject Code	15EE73	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss conduction and breakdown in gases, liquid dielectrics. • To discuss breakdown in solid dielectrics. • To discuss generation of high voltages and currents and their measurement. • To discuss overvoltage phenomenon and insulation coordination in electric power systems. • To discuss non-destructive testing of materials and electric apparatus. • To discuss high-voltage testing of electric apparatus ■ 			
Module-1			Teaching Hours
Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ , Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges. Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-3			
Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-4			
Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE73 HIGH VOLTAGE ENGINEERING (Core Course) (continued)				
Module-5 (continued)				Teaching Hours
High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain conduction and breakdown phenomenon in gases, liquid dielectrics. • Explain breakdown phenomenon in solid dielectrics. • Explain generation of high voltages and currents • Discuss measurement techniques for high voltages and currents. • Discuss overvoltage phenomenon and insulation coordination in electric power systems. • Discuss non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	High Voltage Engineering	M.S. Naidu, V.Kamaraju	McGraw Hill	5 th Edition, 2013.
Reference Books				
1	High Voltage Engineering Fundamentals	E. Kuffel, W.S. Zaengl, J. Kuffel	Newnes	2 nd Edition, 2000
2	High Voltage Engineering	Wadhwa C.L.	New Age International	3 rd Edition, 2012
3	High-Voltage Test and Measuring Techniques	Wolfgang Hauschild • Eberhard Lemke	Springer	1 st Edition 2014
4	High Voltage Engineering	Farouk A.M. Rizk	CRC Press	1 st Edition 2014

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
UTILIZATION OF ELECTRICAL POWER(Professional Elective)			
Subject Code	15EE742	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss electric heating, air-conditioning and electric welding. • To explain laws of electrolysis, extraction and refining of metals and electro deposition. • To explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting • To discuss systems of electric traction, speed time curves and mechanics of train movement. • To discuss motors used for electric traction and their control. • To discuss braking of electric motors, traction systems and power supply and other traction systems. • Give awareness of technology of electric and hybrid electric vehicles. ■ 			
Module-1			Teaching Hours
Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques. Electrolytic Electro – Metallurgical Process: Ionization, Faraday’s Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, Electro Deposition. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion. Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor. Control of motors: Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes. Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE742 UTILIZATION OF ELECTRICAL POWER(Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Traction, Feeding and Distribution System for Dc Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires. Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electric heating, air-conditioning and electric welding. • Explain laws of electrolysis, extraction and refining of metals and electro deposition. • Explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • Design interior and exterior lighting systems- illumination levels for factory lighting- flood lighting- street lighting. • Discuss systems of electric traction, speed time curves and mechanics of train movement. • Explain the motors used for electric traction and their control. • Discuss braking of electric motors, traction systems and power supply and other traction systems. • Explain the working of electric and hybrid electric vehicles. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, The Engineer and Society, Ethics, Individual and Team Work.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	A Textbook on Power System Engineering	A. Chakrabarti et al	Dhanpat Rai and Co	2 nd Edition, 2010
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5)	Mehrddad Ehsani et al	CRC Press	1 st Edition, 2005
Reference Books				
1	Utilization, Generation and Conservation of Electrical Energy	Sunil S Rao	Khanna Publishers	1 st Edition, 2011
2	Utilization of Electric Power and Electric Traction	G.C. Garg	Khanna Publishers	9 th Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS(Professional Elective)			
Subject Code	15EE752	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • Describe the process to plan, control and implement commissioning of electrical equipment's. • Differentiate the performance specifications of transformer and induction motor. • Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears. • Identification of tools and equipment's used for installation and maintenance of electrical equipment. • Explain the operation of an electrical equipment's such as isolators, circuit breakers, insulators and switchgears. ■ 			
Module-1			Teaching Hours
Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safety Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices. Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Test ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.		
Module-4			
Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handling Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE752 TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Professional Elective) (continued)				
Module-5				Teaching Hours
<p>Switchgear and Protective Devices: Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.</p> <p>Domestic Installation: Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation ■</p>				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Describe the process to plan, control and implement commissioning of electrical equipment's. • Differentiate the performance specifications of transformer and induction motor. • Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears. • Describe corrective and preventive maintenance of electrical equipment's. • Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. ■ 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/ Reference Books				
1	Testing, Commissioning, Operation and Maintenance of Electrical Equipment	S. Rao	Khanna Publishers	6 th Edition, 19 th Reprint, 2015
2	Testing and Commissioning of Electrical Equipment	R.L.Chakrasali	Prism Books Pvt Ltd	1 st Edition, 2014
3	Preventive Maintenance of Electrical Apparatus	S.K.Sharotri	Katson Publishing House	1 st Edition, 1980
4	Handbook of Switchgears	BHEL	McGraw Hill	1 st Edition, 2005
5	Transformers	BHEL	McGraw Hill	1 st Edition, 2003
6	TheJ&P Transformer Book	Martin J. Heathcote	Newnes	12 th Edition, 1998

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VII			
POWER SYSTEM SIMULATION LABORATORY			
Subject Code	15EEL76	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> To explain the use of MATLAB package to assess the performance of medium and long transmission lines. To explain the use of MATLAB package to obtain the power angle characteristics of salient and non-salient pole alternator. To explain the use of MATLAB package to study transient stability of radial power systems under three phase fault conditions. To explain the use of MATLAB package to develop admittance and impedance matrices of interconnected power systems. To explain the use of Mi-Power package to solve power flow problem for simple power systems. To explain the use of Mi-Power package to perform fault studies for simple radial power systems. To explain the use of Mi-Power package to study optimal generation scheduling problems for thermal power plants. ■ 			
Sl. No	Experiments		
1	Use of MATLAB package	Formation for symmetric π /T configuration for Verification of $AD - BC = 1$, Determination of Efficiency and Regulation.	
2		Determination of Power Angle Diagrams, Reluctance Power, Excitation, Emf and Regulation for Salient and Non-Salient Pole Synchronous Machines.	
3		To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.	
4		Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation and Inspection Method.	
5		Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm.	
6		Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage (Bus) Profile.	
7	Use of Mi-Power package	Formation of Jacobian for a System not Exceeding 4 Buses (No PV Buses) in Polar Coordinates.	
8		Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses.	
9		To Determine Fault Currents and Voltages in a Single Transmission Line System with Star-Delta Transformers at a Specified Location for LG and LLG faults by simulation.	
10		Optimal Generation Scheduling for Thermal power plants by simulation.	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> Develop a program in MATLAB to assess the performance of medium and long transmission lines. Develop a program in MATLAB to obtain the power angle characteristics of salient and non-salient pole alternator. Develop a program in MATLAB to assess the transient stability under three phase fault at different locations in a of radial power systems. Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems. Use Mi-Power package to solve power flow problem for simple power systems. Use Mi-Power package to study unsymmetrical faults at different locations in radial power systems Use of Mi-Power package to study optimal generation scheduling problems for thermal power plants. ■ 			

<p style="text-align: center;">B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII</p>
<p style="text-align: center;">15EEL76POWER SYSTEM SIMULATION LABORATORY (continued)</p>
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
RELY AND HIGH VOLTAGE LABORATORY			
Subject Code	15EEL77	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type. • To verify the operation of negative sequence relay. • To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay. • To conduct experiments on generator, motor and feeder protection. • To conduct experiments to study the sparkover characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • To measure high AC and DC voltages • To experimentally measure the breakdown strength of transformer oil. • To experimentally measure the capacitance of different electrode configuration models using Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■ 			
Sl. NO	Experiments		
Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. The experiments under Part – D is compulsory.			
1	Part - A	Over Current Relay: (a) Inverse Definite Minimum Time (IDMT) Non-Directional Characteristics (b) Directional Features (c) IDMT Directional.	
2		IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).	
3		Operation of Negative Sequence Relay.	
4	Part - B	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.	
5		Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.	
6		Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage Relay.	
7	Part - C	Generation Protection: Merz Price Scheme.	
8		Feeder Protection against Faults.	
9		Motor Protection against Faults.	
10	Part - D	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS 1876: 2005] and Non-uniform [as per IS 2071 (Part 1) : 1993] Configurations: Sphere – Sphere, Point – Plane, Point – Point and Plane – Plane.	
11		Spark Over Characteristics of Air subjected to High voltage DC.	
12		Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005	
13		Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005	
14		Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/ Transmission Line/ Sphere Gap.	
15		(a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.	
15			
Revised Bloom's Taxonomy Level		L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII
15EEL77 RELY AND HIGH VOLTAGE LABORATORY (continued)
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Experimentally verify the characteristics of over current, over voltage, under voltage and negative sequence relays both electromagnetic and static type. • Experimentally verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay. • Show knowledge of protecting generator, motor and feeders. • Analyze the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • Measure high AC and DC voltages and breakdown strength of transformer oil. • Draw electric field and measure the capacitance of different electrode configuration models. • Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■
<p>Graduate Attributes (As per NBA)</p> <p>Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII			
PROJECT PHASE – I AND SEMINAR			
Subject Code	15EEP78	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 02			
<p>Course objectives:</p> <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. • Demonstrate the knowledge, skills and attitudes of a professional engineer. ■ 			
<p>Graduate Attributes (As per NBA)</p> <p>Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>			
<p>Continuous Internal Evaluation</p> <p>CIE marks for the project report (50 marks) and seminar (50 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■</p>			

**** END ****

VIII SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VIII			
POWER SYSTEM OPERATION AND CONTROL(Core Course)			
Subject Code	15EE81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To describe various levels of controls in power systems and the vulnerability of the system. • To explain components, architecture and configuration of SCADA. • To define unit commitment and explain various constraints in unit commitment and the solution methods • To explain issues of hydrothermal scheduling and solutions to hydro thermal problems • To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control • To explain automatic generation control, voltage and reactive power control in an interconnected power system. • To explain reliability and contingency analysis, state estimation and related issues. ■ 			
Module-1			Teaching Hours
<p>Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centres.</p> <p>Supervisory Control and Data acquisition (SCADA): Introduction to SCADA and its Components, Standard SCADA Configurations, Users of Power Systems SCADA, Remote Terminal Unit for Power System SCADA, Common Communication Channels for SCADA in Power Systems, Challenges for Implementation of SCADA.</p> <p>Unit Commitment: Introduction, Simple Enumeration Constraints, Priority List Method, Dynamic Programming Method for Unit Commitment. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
<p>Hydro-thermal Scheduling: Introduction, Scheduling Hydro Systems, Discrete Time Interval Method, Short Term Hydro Thermal Scheduling Using $\gamma - \lambda$ Iterations, Short Term Hydro Thermal Scheduling Using Penalty Factors.</p> <p>Automatic Generation Control (AGC): Introductions, Basic Generator Control Loops, Commonly used Terms in AGC, Functions of AGC, Speed Governors. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Automatic Generation Control (continued): Mathematical Model of Automatic Load Frequency Control, AGC Controller, Proportional Integral Controller.</p> <p>Automatic Generation Control in interconnected Power system: Introductions, Tie - Line Control with Primary Speed Control, Frequency Bias Tie - Line Control, State-Space Models. ■</p>			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
<p>Automatic Generation Control in interconnected Power system (continued): State-Space Model for Two - Area System, Tie-Line Oscillations, Related Issues in Implementation of AGC.</p> <p>Voltage and Reactive Power Control: Introduction, Production and Absorption of Reactive Power, Methods of Voltage Control, Dependence of Voltage on Reactive Power, Sensitivity of Voltage to Changes in P And Q, Cost Saving, Methods of Voltage Control by Reactive Power Injection, Voltage Control Using Transformers, Voltage Stability. ■</p>			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
15EE81POWER SYSTEM OPERATION AND CONTROL(Core Course) (continued)				
Module-5				Teaching Hours
Power System Reliability and Security: Introduction, Security Levels of System, Reliability Cost, Adequacy Indices, Functions of System Security, Contingency Analysis, Linear Sensitivity Factors, Contingency Selection and Ranking. State estimation of Power Systems: Introduction, Linear Least Square Estimation, DC State Estimator, Other Issues in State Estimation. ■				10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA. • Solve unit commitment problems • Explain issues of hydrothermal scheduling and solutions to hydro thermal problems • Explain basic generator control loops, functions of Automatic generation control, speed governors • Develop and analyze mathematical models of Automatic Load Frequency Control • Explain automatic generation control, voltage and reactive power control in an interconnected power system. • Explain reliability, security, contingency analysis, state estimation and related issues of power systems. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Communication, Life-long Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Power System Operation and Control	K. Uma Rao	Wiley	1 st Edition, 2012
Reference Books				
1	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition, 2003
2	Power System Stability and Control	Kundur	McGraw Hill	8 th Reprint, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII			
INDUSTRIAL DRIVES AND APPLICATIONS(Core Course)			
Subject Code	15EE82	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define electric drive, its parts, advantages and explain choice of electric drive. • To explain dynamics and modes of operation of electric drives. • To explain selection of motor power ratings and control of dc motor using rectifiers. • To analyze the performance of induction motor drives under different conditions. • To explain the control of induction motor, synchronous motor and stepper motor drives. • To discuss typical applications electrical drives in the industry. ■ 			
Module-1			Teaching Hours
Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Selection of Motor Power Ratings: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating. Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed From Fully Controlled Rectifier, Rectifier Control of dc Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited dc Motor, Chopper Control of Series Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques- Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors. Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII				
15EE82 INDUSTRIAL DRIVES AND APPLICATIONS(Core Course) (continued)				
Module-5				Teaching Hours
Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless dc Motor Drives. Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. Industrial Drives: Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the advantages and choice of electric drive. • Explain dynamics and different modes of operation of electric drives. • Suggest a motor for a drive and control of dc motor using controlled rectifiers. • Analyze the performance of induction motor drives under different conditions. • Control induction motor, synchronous motor and stepper motor drives. • Suggest a suitable electrical drive for specific application in the industry. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing House	2 nd Edition, 2001
2	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives under module 5.)	VedumSubrahmanyam	McGraw Hill	2 nd Edition, 2011
Reference Books				
1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1 st Edition, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII			
INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)			
Subject Code	15EE833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain power generation by alternate energy source like wind power and solar power. • To explain selection of size of units and location for wind and solar systems. • Discuss the effects of integration of distributed generation on the performance the system. • To provide practical and useful information about grid integration of distributed generation. ■ 			
Module-1			Teaching Hours
Distributed Generation: Introduction,Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Overloading and Losses(continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Power Quality Disturbances (continued): Low-Frequency Harmonics, High-Frequency Distortion, Voltage Dips, Increasing the Hosting Capacity. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Explain energy generation by wind power and solar power. • Discuss the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems. 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
15EE833 INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)(continued)				
Course outcomes (continued):				
<ul style="list-style-type: none"> • Explain the performance of the system when distributed generation is integrated to the system. • Discuss effects of the integration of DG: the increased risk of overload and increased losses. • Discuss effects of the integration of DG: increased risk of overvoltages, increased levels of power quality disturbances. • Discuss effects of the integration of DG: incorrect operation of the protection • Discuss the impact the integration of DG on power system stability and operation. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, The Engineer and Society, Ethics, Individual and Team Work, Communication, Project Management and Finance, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Integration of Distributed Generation in the Power System	Math Bollen	Wiley	2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII			
INTERNSHIP / PROFESSIONAL PRACTICE			
Subject Code	15EE84	IA Marks	50
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	50
Credits - 02			
<p>Course objectives: Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <ul style="list-style-type: none"> • To put theory into practice. • To expand thinking and broaden the knowledge and skills acquired through course work in the field. • To relate to, interact with, and learn from current professionals in the field. • To gain a greater understanding of the duties and responsibilities of a professional. • To understand and adhere to professional standards in the field. • To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. • To identify personal strengths and weaknesses. • To develop the initiative and motivation to be a self-starter and work independently. ■ 			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p>Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. • Expand intellectual capacity, credibility, judgment, intuition. • Acquire the knowledge of administration, marketing, finance and economics. ■ 			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - VIII**

15EE84INTERNSHIP / PROFESSIONAL PRACTICE(continued)

Continuous Internal Evaluation

CIE marks for the Internship/Professional practice report (25 marks) and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

Semester End Examination

SEE marks for the project report (25 marks) and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VIII			
PROJECT WORK PHASE -II			
Subject Code	15EEP85	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	100
Credits - 06			
Course objectives:			
<ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			
Evaluation Procedure:			
The Internal marks evaluation shall be based on project report and presentation of the same in a seminar.			
Project Report: 50 marks. The basis for awarding the marks shall be the involvement of individual student of the project batch in carrying the project and preparation of project report. To be awarded by the internal guide in consultation with external guide if any.			
Project Presentation: 50 marks. Each student of the project batch shall present the topic of Project Work Phase - II orally and/or through power point slides.			
The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.			
The student shall be evaluated based on:			
Presentation skill for 30 marks and ability in the Question and Answer session for 20 marks. ■			
Semester End Examination			
SEE marks for the project (100 marks)shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) as per the University norms by the examiners appointed VTU. ■			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VIII			
SEMINAR			
Subject Code	15EES86	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 01			
<p>Course objectives:</p> <p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.</p> <ul style="list-style-type: none"> • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Attain, use and develop knowledge in the field of electrical and electronics engineering and other disciplines through independent learning and collaborative study. • Identify, understand and discuss current, real-time issues • Improve oral and written communication skills • Explore an appreciation of the self in relation to its larger diverse social and academic contexts. • Apply principles of ethics and respect in interaction with others. ■ 			
<p>Graduate Attributes (As per NBA):</p> <p>Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			
<p>Evaluation Procedure:</p> <p>The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman.</p> <p>Marks distribution for internal assessment of the course 15EES86 seminar:</p> <p>Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks. ■</p>			



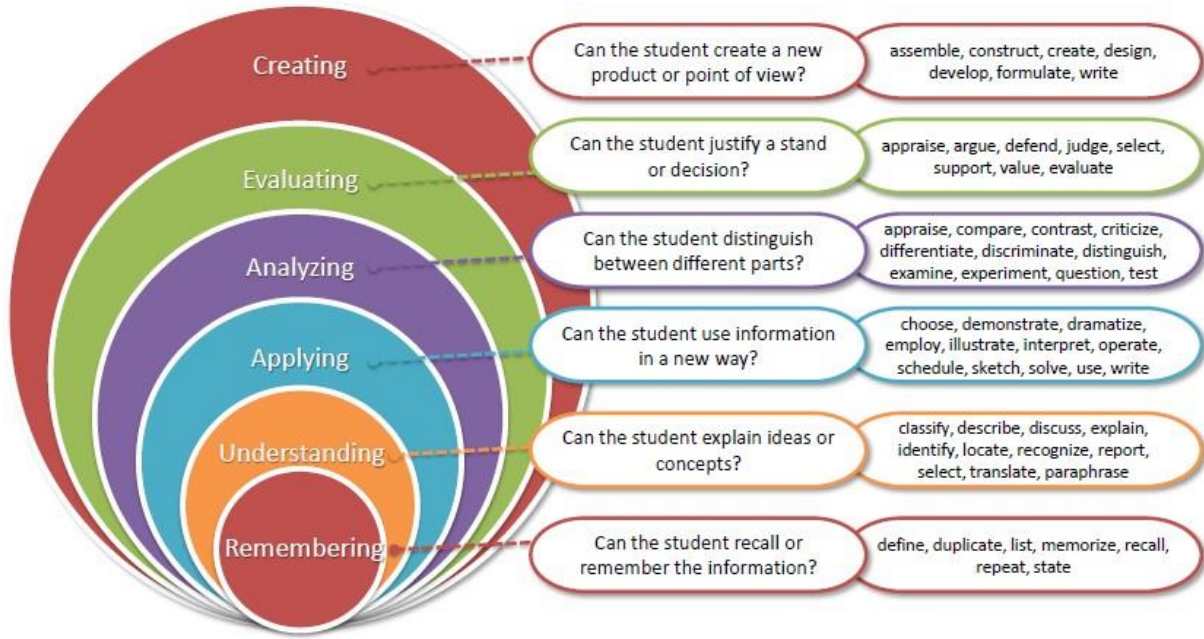
VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
III TO VIII SEMESER
(Effective from Academic year 2015-16)



CATEGORIZATION FOR THE THINKING PROCESS

Bloom's Taxonomy (Revised)



Bloom's Revised Taxonomy Levels, Level Definitions and attributes levels along with action verbs that can be used when developing learning outcomes.			
	Level	Level Definitions and attributes	Verbs(not comprehensive)
Lower order thinking skills (LOTS)	Remembering (Knowledge) <i>L₁</i>	Students exhibit memory/rote memorization of previously learnt materials by recognition, recalling facts, terms, basic concepts, and simple answers. Able to remember, but not necessarily fully understanding the material.	Copy, Choose, Define, Discover, Describe, Duplicate, Enumerate, Find, How, Identify, Label, List, Locate, Listen, Memorize, Match, Name, Omit, Quote, Recall, Relate, Reproduce, Recognize, Select, Show, Spell, Tell, Tabulate, Who, When, Where etc.
	Understanding (Comprehension) <i>L₂</i>	Students demonstrate understanding of facts and ideas by interpreting, exemplifying, classifying, inferring, summarizing, comparing and explaining main ideas with own words.	Ask, Classify, Compare, Contrast, Demonstrate, Describe, Extend, Differentiate, Distinguish, Discuss, Express, Explain, Group, Illustrate, Infer, Interpret, Outline, Paraphrase, Rephrase, Relate, Show, Summarize, Select, Translate, Restate etc.
	Applying (Application) <i>L₃</i>	Students solve problems in new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Calculate, Predict, Apply, Solve, Illustrate, Use, Demonstrate, Determine, Model, Build, Construct, Develop, Experiment With, Identify, Make Use Of, Organize, Plan, Select etc.
Higher order thinking skills (HOTS)	Analysing (Analysis) <i>L₄</i>	Students are able to examine and break information into component parts by identifying motives, causes arrangement, logic and semantics. They can make inferences and find evidence to support generalization.	Analyse, Assume, Break Down, Classify, Categorize, Conclusion, Compare, Contrast, Diagram, Discover, Dissect, Distinguish, Divide, Examine, Function, Illustrate, Inference, Inspect, List, Motive, Outline, Relationships, Simplify, Survey, Take Part In, Test For etc.
	Evaluating (Evaluation) <i>L₅</i>	Students are able to present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. They can justify a decision or course of action.	Agree, Appraise, Assess, Award, Build, Create, Compose, Choose, Compare, Conclude, Criteria, Criticize, Design, Derive, Develop, Decide, Deduct, Determine, Disprove, Defend, Estimate, Formulate, Generate, Invent, Modify, Evaluate, Explain, Influence, Judge, Interpret, Justify, Mark, Measure, Perceive, Rate, Prioritize, Recommend, Rule On, Select, Support, Value etc.
	Creating (Synthesis) <i>L₆</i>	Students are able to compile, generate or view information, ideas or products together in a different way by combining elements in a new pattern or by proposing alternative solutions. Also, use information to form a unique product. This requires creativity and originality.	Assemble, Adapt, Anticipate, Build, Change, Choose, Combine, Collaborate, Collect, Create, Compile, Compose, Construct, Delete, Design, Develop, Discuss, Develop, Devise, Elaborate, Estimate, Formulate, Happen, Hypothesize, Imagine, Improve, Invent, Imagine, Intervene, Make Up, Maximize, Modify, Originate, Plan, Predict, Propose, Rearrange, Solve, Suppose, Substitute, Test etc.
<p>Graduate attributes: Graduate attributes are the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future.</p> <p style="text-align: right;">Bowden, Hart, King, Trigwell & Watts (2000)</p>			

Scheme of Teaching and Examination

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16 B.E. ELECTRICAL AND ELECTRONICS ENGINEERING CHOICE BASED CREDIT SYSTEM (CBCS)

III SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Dept.	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15MAT31	Core Subject	Engineering Mathematics-III	Mathe matics	04	--	03	20	80	100	4
2	15EE32	Core Subject	Electric Circuit Analysis	EEE	04	--	03	20	80	100	4
3	15EE33	Core Subject	Transformers and Generators	EEE	04	--	03	20	80	100	4
4	15EE34	Core Subject	Analog Electronic Circuits	EEE	04	--	03	20	80	100	4
5	15EE35	Core Subject	Digital System Design	EEE	04	--	03	20	80	100	4
6	15EE36	Foundation Course	Electrical and Electronic Measurements	EEE	04	--	03	20	80	100	4
7	15EEL37	Laboratory	Electrical Machines Laboratory -1	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
8	15EEL38	Laboratory	Electronics Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
TOTAL					Theory:24 hours Practical: 06 hours		24	160	640	800	28

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Foundation Course: The courses based upon the content that leads to Knowledge enhancement.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

IV SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Dept.	Teaching Hours /Week		Examination			Credits	
					Theory	Practical/ Drawing	Duration in hours	L.A. Marks	Theory/ Practical Marks		Total Marks
1	15MAT41	Core Subject	Engineering Mathematics-IV	Maths	04	--	03	20	80	100	4
2	15EE42	Core Subject	Power Generation and Economics	EEE	04	--	03	20	80	100	4
3	15EE43	Core Subject	Transmission and Distribution	EEE	04	--	03	20	80	100	4
4	15EE44	Core Subject	Electric Motors	EEE	04	--	03	20	80	100	4
5	15EE45	Core Subject	Electromagnetic Field Theory	EEE	04	--	03	20	80	100	4
6	15EE46	Foundation Course	Operational Amplifiers and Linear ICs	EEE	04	--	03	20	80	100	4
7	15EEL47	Laboratory	Electrical Machines Laboratory -2	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
8	15EEL48	Laboratory	Op- amp and Linear ICs Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	20	80	100	2
TOTAL					Theory:24 hours Practical: 06 hours		24	160	640	800	28

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Foundation Course: The courses based upon the content that leads to Knowledge enhancement.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

V SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15EE51	Core Subject	Management and Entrepreneurship	EEE	04	--	03	80	20	100	4
2	15EE52	Core Subject	Microcontroller	EEE	04	--	03	80	20	100	4
3	15EE53	Core Subject	Power Electronics	EEE	04	--	03	80	20	100	4
4	15EE54	Core Subject	Signals and Systems	EEE	04	--	03	80	20	100	4
5	15EE55X	Professional Elective	Professional Elective – I	EEE	03	--	03	80	20	100	3
6	15EE56Y	Open Elective	Open Elective - I	EEE	03	--	03	80	20	100	3
7	15EEL57	Laboratory	Microcontroller Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	80	20	100	2
8	15EEL58	Laboratory	Power Electronics Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
TOTAL					Theory:22hours Practical: 06 hours		24	160	640	800	26

Elective**Professional Elective****Open Elective^{***}****Offered by the Department of Electrical and Electronics Engineering**

Courses under Code 15EE55X	Title	Courses under Code 15EE55X	Title
15EE551	Introduction to Nuclear Power	15EE561	Electronic Communication systems
15EE552	Electrical Engineering Materials	15EE562	Programmable Logic controllers
15EE553	Estimating and Costing	15EE563	Renewable Energy Systems
15EE554	Special Electrical Machines	15EE564	Business Communication

*** Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives). Selection of an open elective is not allowed provided;

- The candidate has pre – requisite knowledge.
- The candidate has not studied during I and II year of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters.

Registration to electives shall be documented under the guidance of Programme Coordinator and Adviser.

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Electives relevant to chosen specialization/ branch.

3. Open Elective: Electives from other technical and/ or emerging subject areas.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VI SEMESTER

Sl. No	Subject Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15EE61	Core Subject	Control Systems	EEE	04	--	03	80	20	100	4
2	15EE62	Core Subject	Power System Analysis – 1	EEE	04	--	03	80	20	100	4
3	15EE63	Core Subject	Digital Signal Processing	EEE	04	--	03	80	20	100	4
4	15EE64	Core Subject	Electrical Machine Design	EEE	04	--	03	80	20	100	4
5	15EE65X	Professional Elective	Professional Elective – II	EEE	03	--	03	80	20	100	3
6	15EE66Y	Open Elective	Open Elective - II	EEE	03	--	03	80	20	100	3
7	15EEL67	Laboratory	Control System Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	80	20	100	2
8	15EEL68	Laboratory	Digital Signal Processing Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	80	20	100	2
TOTAL					Theory:22 hours Practical: 06 hours		24	160	640	800	26

Elective

Professional Elective		Open Elective ^{***}	
		Offered by the Department of Electrical and Electronics Engineering	
Courses under Code 15EE65X	Title	Courses under Code 15EE66Y	Title
15EE651	Computer Aided Electrical Drawing	15EE661	Artificial Neural Networks and Fuzzy logic
15EE652	Advanced Power Electronics	15EE662	Sensors and Transducers
15EE653	Energy Audit and Demand side Management	15EE663	Batteries and Fuel Cells for Commercial, Military and Space Applications
15EE654	Solar and Wind Energy	15EE664	Industrial Servo Control Systems

^{***}Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives). Selection of an open elective is not allowed provided;

- The candidate has pre – requisite knowledge.
- The candidate has not studied during I and II year of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters.

Registration to electives shall be documented under the guidance of Programme Coordinator and Adviser.

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Electives relevant to chosen specialization/ branch.

3. Open Elective: Electives from other technical and/ or emerging subject areas.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF TEACHING AND EXAMINATION - 2015-16 B.E. ELECTRICAL AND ELECTRONICS ENGINEERING CHOICE BASED CREDIT SYSTEM (CBCS)

VII SEMESTER

Sl. No	Course Code	Subject (Course)	Title	Teaching Department	Teaching Hours/Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EE71	Core Subject	Power System Analysis - 2	EEE	04	--	03	20	80	100	4
2	15EE72	Core Subject	Power System Protection	EEE	04	--	03	20	80	100	4
3	15EE73	Core Subject	High Voltage Engineering	EEE	04	--	03	20	80	100	4
4	15EE74X	Professional Elective	Professional Elective – III	EEE	04	--	03	20	80	100	3
5	15EE75Y	Professional Elective	Professional Elective – IV	EEE	04	--	03	20	80	100	3
6	15EEL76	Laboratory	Power system Simulation Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	20	80	100	2
7	15EEL77	Laboratory	Rely and High Voltage Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	20	80	100	2
8	15EEP78	Project Phase – I + Seminar		EEE	--		--	100	--	100	2
TOTAL					Theory:24 hours Practical: 06 hours		21	240	560	800	24

Elective

Professional Elective – III

Professional Elective – IV

Courses under Code 15EE74X	Title	Courses under Code 15EE75Y	Title
15EE741	Advanced Control Systems	15EE751	FACTs and HVDC Transmission
15EE742	Utilization of Electrical Power	15EE752	Testing and Commissioning of Power System Apparatus
15EE743	Carbon Capture and Storage	15EE753	Spacecraft Power Technologies
15EE744	Power System Planning	15EE754	Industrial Heating

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch.

3. Project Phase –I + Seminar: Literature Survey, Problem Identification, objectives and Methodology. Submission of synopsis and seminar.

4. Internship / Professional Practice: To be carried between the VI and VII semester vacation or VII and VIII semester vacation period.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2015-16
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VIII SEMESTER

Sl. No	Course Code	Subject (Course)	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
					Theory	Practical/ Drawing	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15EE81	Core Subject	Power System Operation and Control	EEE	04	--	03	20	80	100	4
2	15EE82	Core Subject	Industrial Drives and Applications	EEE	04	--	03	20	80	100	4
3	15EE83X	Professional Elective	Professional Elective – V	EEE	03	--	03	20	80	100	3
4	15EE84	Core Subject	Internship / Professional Practice	EEE	Industry Oriented		03	50	50	100	2
5	15EEP85	Core Subject	Project Work Phase -II	EEE	--	06	03	100	100	200	6
6	15EES86	Core Subject	Seminar	EEE	--	04	--	100	--	100	1
TOTAL					Theory:11 hours Practical: 10 hours		15	310	390	700	20

Professional Elective – V

Courses under Code 15EE83X	Title
15EE831	Smart Grid
15EE832	Operation and Maintenance of Solar Electric Systems
15EE833	Integration of Distributed Generation
15EE834	Power System in Emergencies

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch.

3. Internship / Professional Practice: To be carried between the VI and VII semester vacation or VII and VIII semester vacation period.

III SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ENGINEERING MATHEMATICS –III (Core Course)			
Subject Code	15MAT31	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to learn Fourier series, Fourier transforms and Z-transforms, statistical methods , numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variations. ■ 			
Module-1			Teaching Hours
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$. Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula-Falsi Method and Newton-Raphson method. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof) – Problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-5			
Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15MAT31 ENGINEERING MATHEMATICS –III (Core Subject) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendental equations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. • Determine the extremals of functional and solve the simple problems of the calculus of variations. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Text Books				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	2006
5	Higher Engineering Mathematics	H. K.DassEr. Rajnish Verma	S.Chand	First Edition, 2011
Web links and Video Lectures: 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ELECTRIC CIRCUIT ANALYSIS (Core Subject)			
Subject Code	15EE32	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To familiarize the basic laws, source transformations, theorems and the methods of analysing electrical circuits. • To explain the concept of coupling in electric circuits and resonance. • To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs. • To analyze the transient response of circuits with dc and sinusoidal ac input. • To impart basic knowledge on network analysis using Laplace transforms. ■ 			
Module-1			Teaching Hours
Basic Concepts: Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources. Equilibrium equations using KCL and KVL, Duality. Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances. Resonant frequency, Bandwidth and Quality factor at resonance. Practical RL-RC circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Network Theorems: Analysis of networks, with and without dependent ac and dc sources by Thevenin's and Norton's theorems. Analysis of ac and dc circuits for maximum power transfer to resistive and complex loads. Application of Millman's theorem and Super Position theorem to multisource networks. Reciprocity theorem and its application. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Transient Analysis: Review of ordinary linear non homogeneous first and second order differential equations with constant coefficients. Transient analysis of ac and dc circuits by classical method. Transient analysis of dc and ac circuits. Behaviour of circuit elements under switching action ($t = 0$ and $t = \infty$). Evaluation of initial conditions. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. Laplace Transform of network and time domain solution for RL, RC and RLC networks for ac and dc excitations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Unbalanced Three phase systems: Analysis of three phase systems, calculation of real and reactive powers. Two Port networks: Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits. Network functions of one port and two port			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE32 ELECTRIC CIRCUIT ANALYSIS (Core Course) (continued)				
Module-5(continued)				Teaching Hours
Two Port networks (continued): networks, properties of poles and zeros of network functions. Complex Wave analysis: Analysis of simple circuits with non-sinusoidal excitation. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits. • Identify, formulate, and solve engineering problems in the area circuits and systems. • Analyze the solution and infer the authenticity of it. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Engineering Circuit Analysis	William H Hayt et al	McGraw Hill	8th Edition,2014
2	Engineering Circuit Analysis	J David Irwin et al	Wiley India	10th Edition,2014
3	Fundamentals of Electric Circuits	Charles K Alexander Matthew N O Sadiku	McGraw Hill	5th Edition,2013
4	Network Analysis	M.E. Vanvalkenburg	Pearson	3rd Edition,2014
5	Electric Circuits	MahmoodNahvi	McGraw Hill	5th Edition,2009
6	Introduction to Electric Circuits	Richard C Dorf and James A Svoboda	Wiley	9 th Edition,2015
7	Circuit Analysis; Theory and Practice	Allan H Robbins Wilhelm C Miller	Cengage	5 th Edition,2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
TRANSFORMERS AND GENERATORS (Core Course)			
Subject Code	15EE33	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To understand the concepts of transformers and their analysis. • To suggest a suitable three phase transformer connection for a particular operation. • To understand the concepts of generator and to evaluate their performance. • To explain the requirement for the parallel operation of transformers and synchronous generators. ■ 			
Module-1			Teaching Hours
<p>Single phase Transformers: Review of Principle of operation, constructional details of shell type and core type single-phase transformers, EMF equation, losses and commercial efficiency, conditions for maximum efficiency (No question shall be set from the review portion). Salient features of ideal transformer, operation of practical transformer under no - load and on - load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency- commercial and all-day. Voltage regulation and its significance.</p> <p>Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups. Equivalent circuit of three phase transformers. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase. Load sharing in case of similar and dissimilar transformers.</p> <p>Autotransformers and Tap changing transformers: Introduction to auto transformer - copper economy, equivalent circuit, three phase auto connection and voltage regulation. Voltage regulation by tap changing – off circuit and on load.</p> <p>Tertiary winding Transformers: Necessity of tertiary winding, equivalent circuit and voltage regulation, tertiary winding in star/star transformers, rating of tertiary winding. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Transformers (continuation): Cause and effects of harmonics, Current inrush in transformers, noise in transformers. Objects of testing transformers, polarity test, Sumpner's test.</p> <p>Direct current Generator – Review of construction, types, armature windings, relation between no load and terminal voltage (No question shall be set from the review portion). Armature reaction, Commutation and associated problems, no load and full load characteristics. Reasons for reduced dependency on dc generators.</p> <p>Synchronous generators- Review of construction and operation of salient & non-salient pole synchronous generators (No question shall be set from the review portion). Armature windings, winding factors, emf equation. Harmonics – causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
<p>Synchronous generators (continuation): Generator load characteristic. Voltage regulation, excitation control for constant terminal voltage. Generator input and output. Parallel operation of</p>			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE33 TRANSFORMERS AND GENERATORS (Core Course) (continued)				
Module-4(continued)				Teaching Hours
Synchronous generators(continuation): generators and load sharing. Synchronous generator on infinite bus-bars – General load diagram, Electrical load diagram, mechanical load diagram, O – curves and V – curves. Power angle characteristic and synchronizing power.				
Synchronous generators(continuation): Effects of saliency, two-reaction theory, Direct and Quadrature reactance, power angle diagram, reluctance power, slip test. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Synchronous generators(continuation): Open circuit and short circuit characteristics, Assessment of reactance- short circuit ratio, synchronous reactance, adjusted synchronous reactance and Potier reactance. Voltage regulation by EMF, MMF, ZPF and ASA methods.				10
Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators. Starting, synchronizing and control. Hunting and dampers. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the construction and operation and performance of transformers. • Explain different connections for the three phase operations, their advantages and applications. • Explain the construction and operation of Synchronous machines and evaluate the regulation of synchronous machines by different methods. • Analyze the operation of the synchronous machine connected to infinite machine. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electric Machines	D. P. Kothari, et al	McGraw Hill	4 th Edition, 2011
2	Performance and Design of A.C. Machines	M. G. Say	CBS Publishers	3 rd Edition, 2002
3	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2 nd Edition, 2013
4	Electric Machines	MulukuntlaS.Sarma,at el	Cengage	1 st Edition, 2009
5	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6 th Edition, 2014
6	Electrical Machines	M.V. Deshpande	PHI Learning	1 st Edition, 2013
7	Electrical Machines	AbhijitChakrabarti et al	McGraw Hill	1 st Edition, 2015
8	A Textbook of Electrical Machines	K.R.SiddapuraD.B.Raval	Vikas	1 st Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ANALOG ELECTRONIC CIRCUITS (Core Course)			
Subject Code	15EE34	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Provide the knowledge for the analysis of diode and transistor circuits. • Develop skills to design the electronic circuits like amplifiers and oscillators. • Highlight the importance of FET and MOSFET. ■ 			
Module-1			Teaching Hours
Diode Circuits: Review of diodes as rectifiers (No question shall be set from review portion). Diode clipping and clamping circuits. Transistor biasing and stabilization: Operating point, analysis and design of fixed bias circuit, self-bias circuit, Emitter stabilized bias circuit, voltage divider bias circuit, stability factor of different biasing circuits. Problems. Transistor switching circuits: Transistor switching circuits, PNP transistors, thermal compensation techniques. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Transistor at low frequencies: BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model, relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual. Transistor frequency response: General frequency considerations, low frequency response, Miller effect capacitance, high frequency response, multistage frequency effects. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
Multistage amplifiers: Cascade and cascode connections, Darlington circuits, analysis and design. Feedback amplifiers: Feedback concept, different types, practical feedback circuits, analysis and design of feedback circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Power amplifiers: Amplifier types, analysis and design of different power amplifiers, distortion in power amplifiers. Oscillators: Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
FETs: Construction, working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET, JFET and MOSFET amplifiers, analysis and design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE34 ANALOG ELECTRONIC CIRCUITS (Core Subject) (continued)				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Utilize the characteristics of transistor for different applications. • Design and analyze biasing circuits for transistor. • Design, analyze and test transistor circuitry as amplifiers and oscillators. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015
2	Integrated Electronics, Analysis and Digital Circuits and Systems	Jacob Millman et al	McGraw Hill	2nd Edition, 2009
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008
4	Microelectronics Circuits Analysis and Design	Muhammad Rashid	Cengage Learning	2 nd Edition, 2014
5	A Text Book of Electrical Technology, Electronic Devices and Circuits	B.L. Theraja, A.K. Theraja,	S. Chand	Reprint, 2013
6	Electronic Devices and Circuits	Anil K. Maini Vasha Agarval	Wiley	1st Edition, 2009
7	Electronic Devices and Circuits	S.Salivahanan N.Suresh	McGraw Hill	3rd Edition, 2013
8	Fundamentals of Analog Circuits	Thomas L Floyd	Pearson	2nd Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
DIGITAL SYSTEM DESIGN(Core Course)			
Subject Code	15EE35	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of combinational circuit design. • To impart the knowledge of Sequential circuit design. • To provide the basic knowledge about VHDL & its use. ■ 			
Module-1			Teaching Hours
Principles of combinational logic: Definition of combinational, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. Incompletely specified functions (Don't care terms). Simplifying max - term equations. Quine -McClusky minimization technique, Quine - McClusky using don't care terms, Reduced Prime Implicant tables, Map entered variables. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Analysis and design of Combinational Logic: General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-using multiplexers as Boolean function generators. Adders and Subtractors-Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Sequential Circuits: Basic Bistable element, Latches, SR latch, application of SR latch, A Switch debouncer, The SR latch, The gated SR latch. The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The master-slave SR Flip-Flops, The master-slave JK Flip-Flop, Edge Triggered Flip-flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. Characteristic equations, Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 counters using clocked JK Flip-Flops Design of a Synchronous Mod-6 counter using clocked D, T, or SR Flip-Flops. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Sequential Design: Introduction, Mealy and Moore models, State machine notation, synchronous sequential circuit analysis and design. Construction of state Diagrams, Counters Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog. Data-Flow Descriptions: Highlights of Data flow descriptions, Structure of data-flow description, Data type-vectors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE35 DIGITAL SYSTEM DESIGN (Core Course) (continued)				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Design and analyze combinational & sequential circuits • Design circuits like adder, subtractor, code converter etc. • Understand counters and sequence generators. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Digital Logic Applications and	John M Yarbrough	CengageLearn	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill	1 st Edition, 2002
3	Logic and computer design Fundamentals	M. Morris Mano and Charles Kime	Pearson Learning	4 th Edition, 2014
4	Fundamentals of logic design	Charles H Roth, JR and Larry L. Kinney	Cengage Learning	6 th Edition, 2013
5	Fundamentals of Digital Circuits	A. Anand Kumar	PHI	3 rd Edition, 2014
6	Digital Logic Design and VHDL	A.A.Phadke, S.M.Deokar	Wiley India	1 st Edition, 2009
7	Digital Circuits and Design	D.P.Kothari, S.Dhillon	Pearson	First Print 2015
8	HDL Programming (VHDL and Verilog)	Nazeih M. Botros	Cengage Learning	1 st Edition, 2011
9	Circuit Design and Simulation with VHDL	Volnei A Pedroni	PHI	2 nd Edition,

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course)			
Subject Code	15EE36	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To understand the concept of units and dimensions. • To measure resistance, inductance, capacitance by use of different bridges. • To study the construction and working of various meters used for measurement. • To have the working knowledge of electronic instruments and display devices. ■ 			
Module-1			Teaching Hours
Units and Dimensions: Review of fundamental and derived units. SI units (No question shall be set from the review portion). Dimensional equations, problems. Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Measurement of Power, Energy, Power factor and Frequency: Review of Dynamometer wattmeter construction and operation (No question shall be set from the review portions), Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Review of Induction type energy meter construction and operation (No question shall be set from the review portions)]. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Extension of Instrument Ranges: Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characteristics, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT. Magnetic measurements: Introduction, measurement of flux/ flux density, magnetising force and leakage factor. Hopkinson permeameter. Measurement of iron loss by wattmeter method. A brief discussion on measurement of air gap flux and field strength. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electronic and digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), extra features offered by present day meters and their significance in billing. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
15EE36 ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course) (continued)				
Module-5				Teaching Hours
Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. Display multiplexing and zero suppression. Recording Devices: Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders. Magnetic tape recorders, Direct recording, Frequency modulation recording, Pulse duration modulation recording, Digital tape recording, Ultraviolet recorders. Biomedical recorders, Electro Cardio Graph (ECG), Electroencephalograph, Electromyograph. Noise in reproduction. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the importance of units and dimensions. • Measure resistance, inductance and capacitance by different methods. • Explain the working of various meters used for measurement of power and energy. • Explain the working of different electronic instruments and display devices. 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Electrical and electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai and Co	10th Edition
2	A Course in Electronics and Electrical Measurements and Instrumentation	J. B. Gupta	Katson Books	2013 Edition
3	Electrical and electronic Measurements and Instrumentation	Er.R.K. Rajput	S Chand	5th Edition, 2012
4	Electrical Measuring Instruments and Measurements	S.C. Bhargava	BS Publications	2013
5	Modern Electronic Instrumentation and Measuring Techniques	Cooper D and A.D. Heifrick	Pearson	First Edition, 2015
6	Electronic Instrumentation and Measurements	David A Bell	Oxford University	3rd Edition, 2013
7	Electronic Instrumentation	H.S.Kalsi	McGraw Hill	3rd Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL MACHINES LABORATORY - 1			
Subject Code	15EEL37	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • Conducting of different tests on transformers and synchronous machines and evaluation of their performance. • Verify the parallel operation of two single phase transformers. • Study the connection of single phase transformers for three phase operation and phase conversion. • Study of synchronous generator connected to infinite bus. ■ 			
Sl. NO	Experiments		
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.		
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.		
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.		
4	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.		
5	Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.		
6	Scott connection with balanced and unbalanced loads.		
7	Separation of hysteresis and eddy current losses in single phase transformer.		
8	Voltage regulation of an alternator by EMF and MMF methods.		
9	Voltage regulation of an alternator by ZPF method.		
10	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.		
11	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.		
12	Power angle curve of synchronous generator.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Conduct different tests on transformers and synchronous generators and evaluate their performance. • Connect and operate two single phase transformers of different KVA rating in parallel. • Connect single phase transformers for three phase operation and phase conversion. • Assess the performance of synchronous generator connected to infinite bus. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ELECTRONICS LABORATORY			
Subject Code	15EEL38	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To design and test half wave and full wave rectifier circuits. • To design and test different amplifier and oscillator circuits using BJT. • To study the simplification of Boolean expressions using logic gates. • To realize different Adders and Subtractors circuits. • To design and test counters and sequence generators. ■ 			
Sl. No	Experiments		
1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.		
2	Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.		
3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.		
4	Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.		
5	Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.		
6	Simplification, realization of Boolean expressions using logic gates/Universal gates.		
7	Realization of half/Full adder and Half/Full Subtractors using logic gates.		
8	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion and Vice - Versa.		
9	Realization of Binary to Gray code conversion and vice versa.		
10	Design and testing Ring counter/Johnson counter.		
11	Design and testing of Sequence generator.		
12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192, 74193.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Design and test different diode circuits. • Design and test amplifier and oscillator circuits and analyse their performance. • Use universal gates and ICs for code conversion and arithmetic operations. • Design and verify on of different counters. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

**** END ****

IV SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
ENGINEERING MATHEMATICS –IV (Core Subject)			
Subject Code	15MAT41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. ■			
Module-1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor’s series method, modified Euler’s method, Runge - Kutta method of fourth order. Milne’s and Adams-Bashforth predictor and corrector methods (No derivations of formulae). ■			10
Revised Bloom’s Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne’s method. Special Functions: Series solution-Frobenius method. Series solution of Bessel’s differential equation leading to J _n (x)-Bessel’s function of first kind. Basic properties, recurrence relations and orthogonality. Series solution of Legendre’s differential equation leading to P _n (x)-Legendre polynomials. Rodrigue’s formula, problems. ■			10
Revised Bloom’s Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy’s theorem and Cauchy’s integral formula, Residue, poles, Cauchy’s Residue theorem (without proof) and problems. Transformations: Conformal transformations, discussion of transformations: $w = z^2$, $w = e^z$, $w = z + (1/z)(z \neq 0)$ and bilinear transformations-problems. ■			10
Revised Bloom’s Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems. Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying.		
Module-5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student’s t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
15MAT41 ENGINEERING MATHEMATICS – IV (Core Subject) (continued)				
Course outcomes:				
<ul style="list-style-type: none"> • Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems. • Explain the idea of analyticity, potential fields residues and poles of complex potentials in field theory and electromagnetic theory. • Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction. • Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems. • Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Text Books:				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books:				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7 th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	2006
5	Higher Engineerig Mathematics	H. K. Dass and Er. Rajnish Verma	S.Chand publishing	First Edition, 2011
Web links and Video Lectures				
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - IV			
POWER GENERATION AND ECONOMICS(Core Subject)			
Subject Code	15EE42	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Explain the arrangement and operation of hydroelectric, steam, diesel, gas turbine and nuclear power plants and working of major equipment in the plants. • Classification of substation and explain the operation of different substation equipment. • Explain the importance of grounding and different grounding methods used in practice. • Explain the economics of power generation and importance of power factor. 			
Module-1			Teaching Hours
Hydroelectric Power Plants: Hydrology, run off and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the plants based on water flow regulation, water head and type of load the plant has to supply. Water turbines – Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines Governing of turbines, selection of water turbines. Underground, small hydro and pumped storage plants. Choice of size and number of units, plant layout and auxiliaries. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Steam Power Plants: Introduction, Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries. Diesel Power Plant: Introduction, Merits and demerits, selection site, elements of diesel power plant, applications. Gas Turbine Power Plant: Introduction, Merits and demerits, selection site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple steam power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam and diesel power plants. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Nuclear Power Plants: Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Substations: Introduction to Substation equipment; Transformers, High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches, Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments, and power line carrier communication equipment. Classification of substations – indoor and outdoor, Selection of site for substation, Busbar arrangement schemes and single line diagrams of substations.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
15EE42 POWER GENERATION AND ECONOMICS(Core Subject) (continued)				
Module-4 (continued)				Teaching Hours
Substations (continued): Interconnection of power stations. Introduction to gas insulated substation, Advantages and economics of Gas insulated substation. Grounding: Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded, solid grounding, resistance grounding, reactance grounding, resonant grounding. Earthing transformer. Neutral grounding and neutral grounding transformer. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Economics: Introduction, Effect of variable load on power system, classification of costs, Cost analysis. Interest and Depreciation, Methods of determination of depreciation, Economics of Power generation, different terms considered for power plants and their significance, load sharing. Choice of size and number of generating plants. Tariffs, objective, factors affecting the tariff, types. Types of consumers and their tariff. Power factor, disadvantages, causes, methods of improving power factor, Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor. Choice of equipment. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants. • Classify various substations and explain the importance of grounding. • Understand the economic aspects of power system operation and its effects. • Explain the importance of power factor improvement. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem analysis, Engineers and Society, Environment and Sustainability.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module.■ 				
Text/Reference Books				
1	A Course in Power Systems	J.B. Gupta	Katson	2008
2	Generation of Electrical Energy	B.R.Gupta	S. Chand	2015
3	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
4	Power Plant Engineering	P.K. Nag	McGrawHill	4 th Edition, 2014
5	Electrical Power Distribution Systems	V. Kamaraju	McGrawHill	1 st Edition, 2009
6	Electrical Distribution Engineering	Anthony J. Pansini	CRC Press	3 rd Edition, 2006
7	Electrical Distribution Systems	Dale R PatrickEt al	CRC Press	2 nd Edition, 2009
8	A Text Book on Power System Engineering	A.Chakrabarti, et al	DhanpathRai	2 nd Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV TRANSMISSION AND DISTRIBUTION (Core Subject)			
Subject Code	15EE43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the concepts of various methods of generation of power. • To understand the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • To design insulators for a given voltage level. • To calculate the parameters of the transmission line for different configurations and assess the performance of the line. • To study underground cables for power transmission and evaluate different types of distribution systems. 			
Module-1			Teaching Hours
<p>Introduction to power system: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.</p> <p>Overhead transmission lines: A brief introduction to types of supporting structures and line conductors-Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All –aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI),Super thermal resistant aluminium alloy (ZTAI), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), Gap type super thermal resistant aluminium alloy conductor steel reinforced (GZTACSR). Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightning; ground wires.</p> <p>Overhead line Insulators: A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Line parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
<p>Performance of transmission lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal π circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
<p>Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.</p>			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE43 TRANSMISSION AND DISTRIBUTION (Core Subject) (continued)				
Module-4 (continued)				Teaching Hours
Underground cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and dc cables. Limitations of cables. Specification of power cables. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated and uniform loads. Effect of disconnection of neutral in a 3 phase four wire system.				10
Reliability and Quality of Distribution system: Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the concepts of various methods of generation of power. • Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • Design and analyze overhead transmission system for a given voltage level. • Calculate the parameters of the transmission line for different configurations and assess the performance of line. • Explain the use of underground cables and evaluate different types of distribution systems. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design / development of solutions, Engineers and society, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	A Course in Electrical Power	Soni Gupta and Bhatnagar	Dhanpat Rai	-
2	Power System Analysis and Design	J. Duncan Glover et al	Cengage Learning	4th Edition 2008
3	Principles of Power System	V.K. Mehta, Rohit Mehta	S. Chand	1 st Edition 2013
4	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
5	Electrical Power	S.L. Uppal	Khanna Publication	
6	Electrical power systems	C. L. Wadhwa	New Age	5 th Edition, 2009
7	Electrical power systems	Ashfaq Hussain	CBS Publication	
8	Electric Power Distribution	A.S. Pabla	McGraw-Hill	6 th Edition, 2012
9	For High temperature conductors refer www.jpowers.co.jp/english/product/pdf/gap_c1.pdf and Power System Analysis and Design, J. Duncan Glover et al			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV			
ELECTRIC MOTORS (Core Subject)			
Subject Code	15EE44	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study the constructional features of Motors and select a suitable drive for specific application. • To study the constructional features of Three Phase and Single phase induction Motors. • To study different test to be conducted for the assessment of the performance characteristics of motors. • To study the speed control of motor by a different methods. • Explain the construction and operation of Synchronous motor and special motors. 			
Module-1			Teaching Hours
DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. Losses and efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Testing of dc motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests. Three phase Induction motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Performance of three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator; standalone operation and grid connected operation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods Single-phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Synchronous motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE44 ELECTRIC MOTORS (Core Subject) (continued)				
Module-5 (continued)				Teaching Hours
Other motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor and stepper motors. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the constructional features of Motors and select a suitable drive for specific application. • Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method. • Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance. • Control the speed of induction motor by a suitable method. • Explain the operation of Synchronous motor and special motors. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Electric Machines	D. P. Kothari, I. J. Nagrath	McGraw Hill	4th edition, 2011
2	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2nd Edition, 2013
3	Electric Machines	R.K. Srivastava	Cengage Learning	2nd Edition, 2013
4	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
5	Electrical Machines	M.V. Deshpande	PHI Learning	2013
6	Electric Machinery and Transformers	Bhag S Guru at el	Oxford University Press	3 rd Edition, 2012
7	Electric Machinery and Transformers	Irving Kosow	Pearson	2nd Edition, 2012
8	Theory of Alternating Current Machines	Alexander Langsdorf	McGraw Hill	2nd Edition, 2001

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -IV			
ELECTROMAGNETIC FIELD THEORY (Core Subject)			
Subject Code	15EE45	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study different coordinate systems for understanding the concept of gradient, divergence and curl of a vector. • To study the application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations. • To evaluate the energy and potential due to a system of charges. • To study the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • To study the magnetic fields and magnetic materials. • To study the time varying fields and propagation of waves in different media. 			
Module-1			Teaching Hours
<p>Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Problems.</p> <p>Electrostatics: Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
<p>Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Problems.</p> <p>Conductor and Dielectrics: Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Capacitance of two wire line. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
<p>Poisson's and Laplace equations: Derivations and problems, Uniqueness theorem.</p> <p>Steady magnetic fields: Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-4			
<p>Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Problems.</p> <p>Magnetic materials and magnetism: Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Problems. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
15EE45 ELECTROMAGNETIC FIELD THEORY (Core Subject) (continued)				
Module-5				Teaching Hours
Time varying fields and Maxwell's equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Problems. Uniform plane wave: Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Problems. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector. • Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations. • Calculate the energy and potential due to a system of charges. • Explain the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • Explain the behavior of magnetic fields and magnetic materials. • Assess time varying fields and propagation of waves in different media. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Engineering Electromagnetics	William H Hayt et al	McGraw Hill	8 th Edition, 2014
2	Principles of Electromagnetics	Matthew N. O. Sadiku	Oxford	6 th Edition, 2015
3	Fundamentals of Engineering Electromagnetics	David K. Cheng	Pearson	2014
4	Electromagnetism -Theory (Volume -1) -Applications (Volume-2)	Ashutosh Pramanik	PHI Learning	2014
5	Electromagnetic Field Theory Fundamentals	Bhag Guru et al	Cambridge	2005
6	Electromagnetic Field Theory	Rohit Khurana	Vikas Publishing	1 st Edition, 2014
7	Electromagnetics	J. A. Edminister	McGraw Hill	3 rd Edition, 2010
8	Electromagnetic Field Theory and Transmission Lines	Gottapu Sasibhushana Rao	Wiley	1 st Edition, 2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV			
OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course)			
Subject Code	15EE46	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the basics of Linear ICs such as Op-amp, Regulator, Timer & PLL. • To learn the designing of various circuits using linear ICs. • To use these linear ICs for specific applications. • To understand the concept and various types of converters. • To use these ICs, in Hardware projects. 			
Module-1			Teaching Hours
Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback ; voltage series feedback amplifier-gain, input resistance, output resistance, voltage shunt feedback amplifier- gain, input resistance, output resistance. General Linear Applications: D.C. & A.C amplifiers, peaking amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, differential configuration, instrumentation amplifier. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Active Filters: First & Second order high pass & low pass Butterworth filters, higher order filters Band pass filters, Band reject filters & all pass filters. DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Signal generators: Triangular / rectangular wave generator, phase shift oscillator, Wien bridge oscillator, oscillator amplitude stabilization, signal generator output controls. Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Signal processing circuits: Precision half wave & full wave rectifiers limiting circuits, clamping circuits, peak detectors, sample & hold circuits. A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC, dual slope ADC, digital ramp ADC. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Phase Locked Loop (PLL): Basic PLL, components, performance factors, applications of PLL IC 565. Timer: Internal architecture of 555 timer, Mono stable, Astable multivibrators and applications. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS)			

SEMESTER -IV				
15EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course) (continued)				
Course Outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the basics of linear ICs. • Design circuits using linear ICs. • Demonstrate the application of Linear ICs. • Use ICs in the electronic projects. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Design / development of solutions, Conduct investigations of complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books:				
1	Op-Amps and Linear Integrated Circuits	Ramakant A Gayakwad	Pearson	4 th Edition 2015
2	Operational Amplifiers and Linear ICs	David A. Bell	Oxford	3 rd Edition 2011
3	Linear Integrated Circuits; Analysis, Design and Applications	B. Somanthan Nair	Wiley India	2013
4	Linear Integrated Circuits	S. Salivahanan, et al	McGraw Hill	2 nd Edition, 2014
5	Operational Amplifiers and Linear Integrated Circuits	K. Lal Kishore	Pearson	1 st Edition, 2012
6	Linear Integrated Circuits	Muhammad H Rashid	Cengage Learning	1 st Edition, 2014
7	Op-Amps and Linear Integrated Circuits, Concept and Application	James M Fiore	Cengage	2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
ELECTRICAL MACHINES LABORATORY -2			
Subject Code	15EEL47	IA Marks	20
Number of PracticalHours/Week	03	Exam Hours	03
Total Number of PracticalHours	42	Exam Marks	80
Credits - 02			
Course Objectives:			
<ul style="list-style-type: none"> • To perform tests on dc machines to determine their characteristics. • To control the speed of dc motor. • To conduct test for pre-determination of the performance characteristics of dc machines • To conduct load test on single phase and three phase induction motor. • To conduct test on induction motor to determine the performance characteristics. • To conduct test on synchronous motor to draw the performance curves. ■ 			
Sl. No	Experiments		
1	Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.		
2	Field Test on dc series machines.		
3	Speed control of dc shunt motor by armature and field control.		
4	Swinburne's Test on dc motor.		
5	Retardation test on dc shunt motor.		
6	Regenerative test on dc shunt machines.		
7	Load test on three phase induction motor.		
8	No - load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).		
9	Load test on induction generator.		
10	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.		
11	Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.		
12	Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load conditions.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Test dc machines to determine their characteristics. • Control the speed of dc motor. • Pre-determine the performance characteristics of dc machines by conducting suitable tests. • Perform load test on single phase and three phase induction motor to assess its performance. • Conduct test on induction motor to pre-determine the performance characteristics. • Conduct test on synchronous motor to draw the performance curves. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
OP- AMP AND LINEAR ICS LABORATORY			
Subject Code	15EEL48	IA Marks	20
Number of PracticalHours/Week	03	Exam Hours	03
Total Number of PracticalHours	42	Exam Marks	80
Credits - 02			
Course Objectives:			
<ul style="list-style-type: none"> • To conduct different experiments using OP-Amps • To conduct experiments using Linear IC's 			
<p>a) Study of pin details, specifications, application features of IC741 (LM741) and IC555 (Timer) through corresponding datasheets (Datasheets are instruction manuals for electronic components. They explain exactly what a component does and how to use it.).</p> <p>b) Comparison of output performance quantity of an Operational Amplifier obtained by rigging up the circuit with the ideal value of</p> <p>(i) A Non – Inverting Amplifier ($V_{out} = AV_{in}$) (ii) An Inverting Amplifier ($V_{out} = -AV_{in}$) (iii) A Difference Amplifier ($V_{out} = -A(V_p - V_n)$) (iv) A Difference Amplifier with floating inputs ($V_{out} = AV_{in}$) (v) A Non – Inverting Amplifier with negative feedback (ii) An Inverting Amplifier with negative feedback (vi) A Differential Amplifier with a negative feedback (vii) A Differential Amplifier with negative feedback and equalised amplifications.</p> <p>(viii) A Voltage follower (ix) A differential – in differential –out amplifier (x) An instrumentation amplifier</p> <p>c) Plot of input and output transfer characteristics to analyse and conclude that op-amps are rarely used in open-loop.</p> <p>d) Testing of op – amp.</p>			To be covered in 03 Laboratory classes.
Sl. No	Experiments		
1	Design and verify a precision full wave rectifier. Determine the performance parameters.		
2	Design and realize to analyse the frequency response of an op – amp amplifier under inverting and non - inverting configuration for a given gain.		
3	Design and verify the output waveform of an op – amp RC phase shift oscillator for a desired frequency.		
4	Design and realize Schmitt trigger circuit using an op – amp for desired upper trip point (UTP) and lower trip point (LTP).		
5	Verify the operation of an op – amp as (a) voltage comparator circuit and (b) zero crossing detector.		
6	Design and verify the operation of op – amp as an (a) adder (b) subtractor (c) integrator and (d) differentiator.		
7	Design and realize an op – amp based first order Butterworth (a) low pass (b) high pass and (c) band pass filters for a given cut off frequency/frequencies to verify the frequency response characteristic.		
8	Design and realize an op – amp based function generator to generate sine, square and triangular waves of desired frequency.		
9	Design and realization of R-2R ladder DAC.		
10	Realization of Two bit Flash ADC		
11	Design and verify an IC 555 timer based pulse generator for the specified pulse.		
12	Designing of Fixed voltage power supply (voltage regulator) using IC regulators 78 series and 79 series.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • To conduct experiment to determine the characteristic parameters of OP-Amp • To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV
15EEL48 OP- AMP AND LINEAR ICS LABORATORY (continued)
Course Outcomes (continued): <ul style="list-style-type: none">• To design test the OP-Amp as oscillators and filters• Design and study of Linear IC's as multivibrator power supplies.
Graduate Attributes (As per NBA) Engineering Knowledge, Individual and Team work, Communication.
Conduct of Practical Examination: <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

**** END ****

V SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V			
MANAGEMENT AND ENTREPRENEURSHIP (Core Course)			
Subject Code	15EE51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process. • To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff, the social responsibility of business and leadership. • To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship. • To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs • To discuss the importance of Small Scale Industries and the related terms and problems involved. • To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan. • To introduce the concepts of project management and discuss capital building process. • To explain project feasibility study and project appraisal and discuss project financing • To discuss about different institutions at state and central levels supporting business enterprises. ■ 			
Module-1			Teaching Hours
Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession. Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment. Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V	
15EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)	
Module-4	Teaching Hours
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only). Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions. ■</p>	10
<p>Revised Bloom’s Taxonomy Level</p>	L ₃ – Applying.
Module-5	
<p>Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation. New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM . ■</p>	10
<p>Revised Bloom’s Taxonomy Level</p>	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process. • Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff in exercising the authority and delegating duties. • To explain the social responsibility of business and leadership • Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development. • Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation. • Discuss the concepts of project management, capitol building process, project feasibility study, project appraisal and project financing. • Discuss the state /central level institutions / agencies supporting business enterprises. ■ 	
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)				
Textbooks				
1	Principles of Management	P.C.Tripathi, P.N.Reddy	McGraw Hill,	6 th Edition, 2017
2	Entrepreneurship Development And Small Business Enterprises	Poornima M.Charanthimath	Pearson	2 nd Edition,2014
Reference Books				
1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership perspective	Harold Koontz, Heinz Weihrich	McGraw Hill	10 th Edition 2016

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
MICROCONTROLLER (Core Course)			
Subject Code	15EE52	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain the internal organization and working of Computers, microcontrollers and embedded processors. • Compare and contrast the various members of the 8051 family. • To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions. • To explain in detail the execution of 8051 Assembly language instructions and data types • To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions. • To explain different addressing modes of 8051, arithmetic, logic instructions, and programs. • To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic, arithmetic operations and data conversion. ■ 			
Module-1			Teaching Hours
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
8051 programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C 8051 Timer programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
8051 serial port programming in assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. 8051 Interrupt programming in assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE52 MICROCONTROLLER (Core Course) (continued)				
Module-5				Teaching Hours
Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and sensor interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. Motor control: Relay, PWM, DC and stepper motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM. 8051 interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255. ■				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051. • Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions. • Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs. • Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization • Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051 to the RS232. • Discuss in detail 8051 interrupts and writing interrupt handler programs. • Interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors. • Interface 8031/51 with external memories, 8255 chip to add ports and relays, opt isolators and motors. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2 nd Edition, 2008.
Reference Books				
1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3 rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1 st Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
POWER ELECTRONICS (Core Course)			
Subject Code	15EE53	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics. • To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits. • To explain the techniques for design and analysis of single phase diode rectifier circuits. • To explain different power transistors, their steady state and switching characteristics and imitations. • To explain different types of Thyristors, their gate characteristics and gate control requirements. • To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■ 			
Module-1			Teaching Hours
Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches. Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Diode Switched <i>RL</i> Load, Freewheeling Diodes with Switched <i>RL</i> Load. Diode Rectifiers: Introduction, Single-Phase Full-Wave Rectifiers, Single-Phase Full-Wave Rectifier with <i>RL</i> Load, Single-Phase Full-Wave Rectifier with a Highly Inductive Load. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-2			
Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-3			
Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, <i>di/dt</i> Protection, <i>dv/dt</i> Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-4			
Controlled Rectifiers: Introduction, Single-Phase Full Converters, Single-Phase Dual Converters, Three-Phase Full Converters, Three-Phase Dual Converters, AC Voltage Controllers: Introduction, Single-Phase Full-Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE53 POWER ELECTRONICS (Core Course) (continued)				
Module-5				Teaching Hours
DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification. DC-AC converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain application area of power electronics, types of power electronic circuits and switches their characteristics and specifications. • Explain types of power diodes, their characteristics, and the effects of power diodes on RL circuits. • Explain the techniques for design, operation and analysis of single phase diode rectifier circuits. • Explain steady state, switching characteristics and gate control requirements of different power transistors and their limitations. • Discuss different types of Thyristors, their operation, gate characteristics and gate control requirements. • Explain designing, analysis techniques and characteristics of thyristor controlled rectifiers. • Discuss the principle of operation of single phase and three phase DC - DC, DC –AC converters and AC voltage controllers. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014
Reference Books				
1	Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
2	Power Electronics	Daniel W Hart	McGraw Hill	1 st Edition, 2011
3	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER – V			
SIGNALS AND SYSTEMS (Core Course)			
Subject Code	15EE54	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss arising of signals in different systems. • To classify the signals and define certain elementary signals. • To explain basic operations on signals and properties of systems. • To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains. • To explain the properties of linear time invariant systems in terms of impulse response description. • To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it. • To explain Fourier transform representation of continuous time and discrete time non –periodic signals and the properties of Fourier Transforms. • To explain the applications of Fourier transform representation to study signals and linear time invariant systems. • To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■ 			
Module-1			Teaching Hours
Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L – 4 Analysing, L ₅ – Evaluating.		
Module-2			
Time – Domain Representations For LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of differential equations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating..		
Module-5			
Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE54 SIGNALS AND SYSTEMS (Core Subject) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Classify the signals and systems. • Explain basic operations on signals and properties of systems. • Use convolution in both continuous and discrete domain for the analysis of systems given the impulse response of a system. • Evaluate response of a given linear time invariant system. • Provide block diagram representation of a linear time invariant system. • Apply continuous time Fourier transform representation to study signals and linear time invariant systems. • Apply discrete time Fourier transform representation to study signals and linear time invariant systems. Use Z-transform and properties of Z transform for the analysis of discrete time systems. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2 nd Edition,2002
Reference Books				
2	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2 nd Edition 2010
3	Signals and Systems	NagoorKani	McGraw Hill	1 st Edition 2010
4	Signals and Systems A Primer with MATLAB	Matthew N.O. Sadiku Warsame H. Ali	CRC Press	1 st Edition, 2016
5	Signals and Systems	Anand Kumar	PHI	3 rd Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V			
ELECTRICAL ENGINEERING MATERIALS (Professional Elective)			
Subject Code	15EE552	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits – 03			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications. • To impart the knowledge of superconducting materials and their applications • To impart the knowledge of plastics and materials for Opto - Electronic devices. ■ 			
Module-1			Teaching Hours
<p>Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.</p> <p>Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems . ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Conductive Materials and Applications: Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.</p> <p>Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behaviour of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.</p> <p>Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
<p>Magnetic Materials (continued):Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.</p> <p>Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field</p>			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
15EE552 ELECTRICAL ENGINEERING MATERIALS (Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Superconductive Materials (continued): and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London's theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic. Materials for Opto – Electronic Devices: Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electrical and electronics materials, their importance, classification and operational requirement • Discuss conducting materials used in engineering, their properties and classification. • Discuss dielectric materials used in engineering, their properties and classification. • Discuss insulating materials used in engineering, their properties and classification. • Discuss magnetic materials used in engineering, their properties and classification • Explain the phenomenon superconductivity, super conducting materials and their application in engineering. • Explain the plastic and its properties and applications. • Discuss materials used for Opto electronic devices. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Advanced Electrical and Electronics Materials; Processes and Applications	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015
Reference Books				
1	Electronic Engineering Materials	R.K. Shukla Archana Singh	McGraw Hill	2012
2	Electrical Properties of Materials	L Solymer et al	Oxford	9 th Edition, 2014
3	Electrical Engineering Materials	A.J. Dekker	Pearson	2016
4	Principle of Electronic Materials and Devices	S.O. Kasap	McGraw Hill	3 rd Edition 2010

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V			
PROGRAMMABLE LOGIC CONTROLLERS (Open Elective)			
Subject Code	15EE562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC. • To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map. • To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction. • To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs. • To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays. • To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions. • To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems. • To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction. • To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions. • To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations. • To describe the operation of bit and word shift registers and develop programs that use shift registers. • To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ■ 			
Module-1			Teaching Hours
<p>Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.</p> <p>PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).</p> <p>Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,		
Module-2			
<p>Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.</p> <p>Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V	
15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)	
Module-3	Teaching Hours
<p>Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.</p> <p>Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,.
Module-4	
<p>Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.</p> <p>Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.
Module-5	
<p>Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.</p> <p>Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions. • Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming. • Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module. • Convert relay schematics and narrative descriptions into PLC ladder logic programs • Analyze PLC timer and counter ladder logic programs • Describe the operation of different program control instructions • Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system. • Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■ 	
Graduate Attributes (As per NBA)	
Engineering Knowledge	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. <p>Students will have to answer 5 full questions, selecting one full question from each module. ■</p>	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
15EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)				
Textbook				
1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill,	4 th Edition, 2011
Reference Book				
1	Programmable Logic Controllers an Engineer's Guide,	E A Parr	Newnes	3 rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3 rd Edition, 2006

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V RENEWABLE ENERGY RESOURCES(Open Elective)			
Subject Code	15EE563	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. • To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships • To discuss about solar energy reaching the Earth’s surface and solar thermal energy applications. • To discuss types of solar collectors, their configurations and their applications • To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications. • To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages. • To discuss wind turbines, wind resources, site selection for wind turbine • To discuss geothermal systems, their classification and geothermal based electric power generation • To discuss waste recovery management systems, advantages and disadvantages • To discuss biomass production, types of biomass gasifiers, properties of producer gas. • To discuss biogas, its composition, production, benefits. • To discuss tidal energy resources, energy availability, power generation. • To explain motion in the sea wave, power associated with sea wave and energy availability and the devices for harnessing wave energy. • To discuss principles of ocean thermal energy conversion and production of electricity. ■ 			
Module-1			Teaching Hours
<p>Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.</p> <p>Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth’s Surface, Solar Thermal Energy Applications.</p> <p>■</p>			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
<p>Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond.</p> <p>Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems. ■</p>			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.</p> <p>Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.</p> <p>Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.</p>			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V	
15EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)	
Module-3 (continued)	Teaching Hours
Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.
Module-4	
Biomass Energy: Biomass Production, Energy Plantation,Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.	
Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.	
Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.
Module-5	
Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.	
Ocean Thermal Energy: Introduction,Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.
Course outcomes: At the end of the course the student will be able to:	
<ul style="list-style-type: none"> • Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. • Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy applications. • Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications. • Discuss generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse. • Discuss production of energy from biomass, biogas. • Discuss tidal energy resources, energy availability and power generation. • Discuss power generation sea wave energy and ocean thermal energy. ■ 	
Graduate Attributes (As per NBA) Engineering Knowledge,Problem Analysis,Modern tool usage,Ethics.	
Question paper pattern:	
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. 	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
15EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)				
Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1 st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3 rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3 rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1 st Edition, 2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -V			
MICROCONTROLLER LABORATORY - 1			
Subject Code	15EEL57	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions. • To explain writing assembly language programs for code conversions. • To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers. • To perform interfacing of stepper motor and dc motor for controlling the speed. • To explain generation of different waveforms using DAC interface. ■ 			
Sl. NO	Experiments		
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.			
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.		
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for 16 bit numbers.		
3	Counters		
4	Boolean and logical instructions (bit manipulation).		
5	Conditional call and return instructions.		
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa decimal to and Decimal to Hexa.		
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.		
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.			
8	Stepper motor interface.		
9	DC motor interface for direction and speed control using PWM.		
10	Alphanumerical LCD panel interface.		
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.		
12	External ADC and Temperature control interface.		
13	Elevator interface.		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions. • Write ALP for code conversions. • Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers. • Perform interfacing of stepper motor and dc motor for controlling the speed. • Generate different waveforms using DAC interface. • Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.			

<p style="text-align: center;">B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -V</p>
<p style="text-align: center;">15EEL57 MICROCONTROLLER LABORATORY – 1(continued)</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.■
<p>Learning beyond the syllabus: To acquire a wide variety of skills and to develop society friendly applications mini projects can be practiced by referring to “Microcontroller Based Projects” Second Edition, An EFY (Electronics For You) Enterprise Pvt Ltd, 2013.</p>

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V POWER ELECTRONICS LABORATORY			
Subject Code	15EEL58	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments on semiconductor devices to obtain their static characteristics. • To study different methods of triggering the SCR • To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • To control the speed of a dc motor, universal motor and stepper motors. • To study single phase full bridge inverter connected to resistive load. • To study commutation of SCR. ■ 			
Sl. No	Experiments		
1	Static Characteristics of SCR.		
2	Static Characteristics of MOSFET and IGBT.		
3	Characteristic of TRIAC.		
4	SCR turn on circuit using synchronized UJT relaxation oscillator.		
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.		
6	Single phase controlled full wave rectifier with R and R –L loads.		
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.		
8	Speed control of dc motor using single semi converter.		
9	Speed control of stepper motor.		
10	Speed control of universal motor using ac voltage regulator.		
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.		
12	Design of Snubber circuit.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Obtain static characteristics of semiconductor devices to discuss their performance. • Trigger the SCR by different methods • Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • Control the speed of a dc motor, universal motor and stepper motors. • Verify the performance of single phase full bridge inverter connected to resistive load. • Perform commutation of SCR by different methods. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

VI SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI			
CONTROL SYSTEMS (Core Subject)			
Subject Code	15EE61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define a control system • To explain the necessity of feedback and types of feedback control systems. • To introduce the concept of transfer function and its application to the modeling of linear systems. • To demonstrate mathematical modeling of control systems. • To obtain transfer function of systems through block diagram manipulation and reduction • To use Mason's gain formula for finding transfer function of a system • To discuss transient and steady state time response of a simple control system. • To discuss the stability of linear time invariant systems and Routh - Hurwitz criterion • To investigate the trajectories of the roots of the characteristic equation when a system parameter is varied. • To conduct the control system analysis in the frequency domain. • To analyze stability of a control system using Nyquist plot. • To discuss stability analysis using Bode plots. • To determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications. ■ 			
Module-1			Teaching Hours
Introduction to control systems: Introduction, classification of control systems. Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Block diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function. Signal flow graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants, types of control systems. Routh Stability criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Root locus technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus. Frequency Response analysis: Co-relation between time and frequency response – 2 nd order systems only. Bode plots: Basic factors $G(i\omega)/H(j\omega)$, General procedure for constructing bode plots, computation of gain margin and phase margin. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
15EE61 CONTROL SYSTEMS (Core Subject) (continued)				
Module-5				Teaching Hours
<p>Nyquist plot: Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.</p> <p>Design of Control Systems: Introduction, Design with the PD Controller, Design with the PI Controller, Design with the PID Controller, Design with Phase-Lead Controller, Design with Phase - Lag Controller, Design with Lead-Lag Controller. ■</p>				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss the effects of feedback and types of feedback control systems. • Evaluate the transfer function of a linear time invariant system. • Evaluate the stability of linear time invariant systems. • Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems. • Demonstrate the knowledge of mathematical modeling of control systems and components • Determine transient and steady state time response of a simple control system. • Investigate the performance of a given system in time and frequency domains. • Discuss stability analysis using Root locus, Bode plots and Nyquist plots. • Determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications. 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Modern Tool Usage, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Control Systems	Anand Kumar	PHI	2 nd Edition, 2014
ReferenceBooks				
1	Automatic Control Systems	FaridGolnaraghi, Benjamin C. Kuo	Wiley	9 th Edition, 2010
2	Control Systems Engineering	Norman S. Nise	Wiley	4 th Edition, 2004
3	Modern Control Systems	Richard C Dorf et al	Pearson	11 th Edition, 2008
4	Control Systems, Principles and Design	M.Gopal	McGaw Hill	4 th Edition, 2012
5	Control Systems Engineering	S. Salivahanan et al	Pearson	1 st Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
POWER SYSTEM ANALYSIS – 1 (Core Subject)			
Subject Code	15EE62	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the per unit system and explain its advantages and computation. • To explain the concept of one line diagram and its implementation in problems. • To explain the necessity and conduction of short circuit analysis. • To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems. • To discuss selection of circuit breaker. • To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits. • To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits. • To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines. • To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. • To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine • Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system. ■ 			
Module-1			Teaching Hours
Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of electrical Power, Representation of Loads. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System, Measurement of sequence Impedance of Synchronous Generator. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE62 POWER SYSTEM ANALYSIS – 1 (Core Subject) (continued)				
Module-5				Teaching Hours
Power System Stability: Introduction, Dynamics of a Synchronous Machine, Power Angle Equation Salient and Non – Salient pole Synchronous Machines, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability. ■				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Show understanding of per unit system, its advantages and computation. • Show the concept of one line diagram and its implementation in problems • Perform short circuit analysis on a synchronous machine and simple power system to select a circuit breaker for the system. • Evaluate symmetrical components of voltages and currents in un-balanced three phase circuits. • Explain the concept of sequence impedance and sequence networks of power system components and power system. • Analyze three phase synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. • Discuss the dynamics of synchronous machine, stability and types of stability. • Discuss equal area criterion for the evaluation of stability of a simple system under different fault conditions. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, The Engineer and Society, Ethics				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1.	Modern Power System	D. P. Kothari	McGraw Hill	4 th Edition, 2011
ReferenceBooks				
1	Elements of Power System	William D. Stevenson Jr	McGraw Hill	4 th Edition, 1982
2	Power System Analysis and Design	J.Duncan Glover et al	Cengage	4 th Edition, 2008
3	Power System Analysis	Hadi Sadat	McGraw Hill	1 st Edition, 2002

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
DIGITAL SIGNAL PROCESSING (Core Subject)			
Subject Code	15EE63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define Discrete Fourier transform and its properties. • To evaluate DFT of various signals using properties of DFT. • To explain different linear filtering techniques. • To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms • To discuss impulse invariant transformation, bilinear transformation techniques and their properties. • To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques. • To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques. • To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter. • To discuss window functions used for the design of FIR filters. • To discuss windowing technique of designing FIR filter. • To discuss frequency sampling technique of designing FIR filter. • To discuss direct, cascade and linear phase form of realizing a digital FIR filter. ■ 			
Module-1			Teaching Hours
Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham’s method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-2			
Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-3			
Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-4			
Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type I filter by impulse invariant transformation and bilinear transformation, Frequency transformations. Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE63 DIGITAL SIGNAL PROCESSING (Core Subject) (continued)				
Module-5				Teaching Hours
Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, design of FIR digital filters by use of windows, Design of FIR digital filters -frequency sampling techniques. Realization of FIR systems: direct form, cascade form, linear phase form ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Compute the DFT of various signals using its properties and linear filtering of two sequences. • Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence • Design infinite impulse response Butterworth digital filters using impulse invariant / bilinear transformation technique. • Design infinite impulse response Chebyshev digital filters using impulse invariant or bilinear transformation technique. • Realize a digital IIR filter by direct, cascade, parallel and ladder methods of realization. • Discuss different window functions and frequency sampling method used for design of FIR filters. • Design FIR filters by use of window function or by frequency sampling method. • Realize a digital FIR filter by direct, cascade, and linear phase form. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Design/ Development of Solutions, Modern Tool Usage.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson	1 st Edition, 2016
Reference Books				
1.	Digital Signal Processing – Principles, Algorithms, and Applications	Jhon G. Proakis Dimitris G. Manolakis	Pearson	4 th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill	2 nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley	2 nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage	1 st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford	1 st Edition, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
ELECTRICAL MACHINE DESIGN (Core Course)			
Subject Code	15EE64	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines. • To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines. • To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines. • To discuss the selection of specific loadings, for various machines. • To discuss separation of main dimensions for different electrical machines • To discuss design of field windings for DC machines and synchronous machines. • To evaluate the performance parameters of transformer, induction motor. • To design of cooling tubes for the transformer for a given temperature rise. • To explain design of rotor of squirrel cage rotor and slip ring rotor. • To define short circuit ratio and discuss its effect on machine performance. ■ 			
Module-1			Teaching Hours
Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques. Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
15EE64 ELECTRICAL MACHINE DESIGN (Core Course) (continued)				
Module-5				
Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding. ■				10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss design factors, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines. • Derive the output equations of transformer, DC machines and AC machines. • Discuss selection of specific loadings and magnetic circuits of different electrical machines • Design the field windings of DC machine and Synchronous machine. • Design stator and rotor circuits of a DC and AC machines. • Estimate the number of cooling tubes, no load current and leakage reactance of core type transformer. • Discuss short circuit ratio and its effects on performance of synchronous machines. • Design salient pole and non-salient pole alternators for given specifications. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	A course in Electrical Machine design	A.K.Sawhney	DhanpatRai	6 th Edition, 2013
Reference Books				
1	Performance and Design of Alternating Current Machines	M.G. Say	CBS Publisher	3 rd Edition, 2002
2	Design Data Handbook	A. Sanmugasundaram Et al	New Age International	1 st Edition, 2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI COMPUTER AIDED ELECTRICAL DRAWING (Professional Elective)			
Subject Code	15EE651	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss the terminology of DC and AC armature windings. • To discuss design and procedure to draw armature winding diagrams for DC and AC machines. • To discuss the substation equipment, their location in a substation and development of a layout for substation. • To discuss different sectional views of transformers, DC machine, its parts and alternator and its parts. • To explain development of sectional views of Transformers, DC machine and alternators using the design data, sketches. ■ 			
Suitable CAD software can be used for drawings			
PART - A			
Module-1			Teaching Hours
Winding Diagrams: (a) Developed Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings. (b) Developed Winding Diagrams of A.C. Machines: (c) Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings. (d) Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Single Line Diagrams: Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power-Line Carrier) and Line Trap. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
PART - B			
Module-3			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Alternator – Sectional Views of Stator and Rotor dealt separately. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
15EE651 COMPUTER AIDED ELECTRICAL DRAWING (Professional Elective) (continued)				
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss the terminology and types of DC and AC armature windings. • Develop armature winding diagram for DC and AC machines • Develop a layout for substation using the standard symbols for substation equipment. . • Draw sectional views of core and shell types transformers using the design data • Draw sectional views of assembled DC machine or its parts using the design data or the sketches. • Draw sectional views of assembled alternator or its parts using the design data or the sketches. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have two parts, PART – A and PART – B. • Each part is for 40 marks. • Part A is for Modules 1 and 2. • Questions 1 and 2 of PART - A will be only on DC windings or only on AC windings. Students have to answer any one of them. The marks prescribed is 25. • Question 3 of PART – A covering module 2 is compulsory. The marks prescribed is 15. • Part B is for Modules 3, 4 and 5. • Questions 4 and 5 will cover any two modules of modules 3, 4 and 5. Students have to answer any one of them. The marks prescribed is 40. ■ 				
Reference Books				
1	A course in Electrical Machine design	A. K. Sawhney	DhanpatRai	6 th Edition, 2013
2	Electrical Engineering Drawing	K. L. Narang	SatyaPrakashan	2014

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – VI			
SENSORS AND TRANSDUCERS(Open Elective)			
Subject Code	15EE662	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits – 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss need of transducers, their classification, advantages and disadvantages. • To discuss working of different types of transducers and sensors.. • To discuss recent trends in sensor technology and their selection. • To discuss basics of signal conditioning and signal conditioning equipment. • To discuss configuration of Data Acquisition System and data conversion. • To discuss the basics of Data transmission and telemetry. • To explain measurement of various non-electrical quantities.■ 			
Module-1			Teaching Hours
Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers. Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Data Transmission and Telemetry: Data/Signal Transmission, Telemetry. Measurement of Non – Electrical Quantities: Pressure Measurement ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – VI				
15EE662 SENSORS AND TRANSDUCERS(Open Elective) (continued)				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss need of transducers, their classification, advantages and disadvantages. • Show an understanding of working of various transducers and sensors. • Discuss recent trends in sensor technology and their selection. • Discuss basics of signal conditioning and signal conditioning equipment. • Discuss configuration of Data Acquisition System and data conversion. • Show knowledge of data transmission and telemetry. • Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3 rd Edition, 2013.
Reference Books				
1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13 th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -VI			
CONTROL SYSTEM LABORATORY			
Subject Code	15EEL67	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To determine the time and frequency domain responses of a given second order system using software package or discrete components. • To design and analyze Lead, Lag and Lead – Lag compensators for given specifications. • To draw the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair. • To simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system. • To write a script files to plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package. ■ 			
Sl. NO	Experiments		
1	Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor		
2	Experiment to draw synchro pair characteristics		
3	Experiment to determine frequency response of a second order system		
4	(a) To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lead compensating network.		
5	(a) To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lag compensating network		
6	Experiment to draw the frequency response characteristics of the lag – lead compensator network and determination of its transfer function.		
Experiments 7 to 11 must be done using MATLAB/SCILAB only.			
7	(a) To simulate a typical second order system and determine step response and evaluate time response specifications. (b) To evaluate the effect of additional poles and zeros on time response of second order system. (c) To evaluate the effect of pole location on stability (d) To evaluate the effect of loop gain of a negative feedback system on stability.		
8	To simulate a second order system and study the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.		
9	(a) To simulate a D.C. Position control system and obtain its step response. (b) To verify the effect of input waveform, loop gain and system type on steady state errors. (c) To perform trade-off study for lead compensator. (d) To design PI controller and study its effect on steady state error.		
10	(a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response (b) To study the effect of open loop gain on transient response of closed loop system using root locus.		
11	(a) To study the effect of open loop poles and zeros on root locus contour (b) To estimate the effect of open loop gain on the transient response of closed loop system using root locus. (c) Comparative study of Bode, Nyquist and root locus with respect to stability.		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -VI**

15EEL67 CONTROL SYSTEM LABORATORY(continued)

Course outcomes: At the end of the course the student will be able to:

- Use software package or discrete components in assessing the time and frequency domain responses of a given second order system.
- Design and analyze Lead, Lag and Lead – Lag compensators for given specifications.
- Determine the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair used in control systems.
- Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- Write a script files to plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package.
- Work with a small team to carryout experiments and prepare reports that present lab work. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI			
DIGITAL SIGNAL PROCESSING LABORATORY			
Subject Code	15EEL68	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain the use of MATLAB software in evaluating the DFT and IDFT of given sequence • To verify the convolution property of the DFT • To design and implementation of IIR and FIR filters for given frequency specifications. • To realize IIR and FIR filters. • To help the students in developing software skills. ■ 			
Sl. No	Experiments		
1	Verification of Sampling Theorem both in time and frequency domains		
2	Evaluation of impulse response of a system		
3	To perform linear convolution of given sequences		
4	To perform circular convolution of given sequences using (a) the convolution summation formula (b) the matrix method and (c) Linear convolution from circular convolution with zero padding.		
5	Computation of N – point DFT and to plot the magnitude and phase spectrum.		
6	Linear and circular convolution by DFT and IDFT method.		
7	Solution of a given difference equation.		
8	Calculation of DFT and IDFT by FFT		
9	Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters)		
10	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions		
11	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique.		
12	Realization of IIR and FIR filters		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating,		
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Give physical interpretation of sampling theorem in time and frequency domains. • Evaluate the impulse response of a system. • Perform convolution of given sequences to evaluate the response of a system. • Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods. • Provide a solution for a given difference equation. • Design and implement IIR and FIR filters • Conduct experiments using software and prepare reports that present lab work ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■ 			

*** END ***

VII SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
POWER SYSTEM ANALYSIS – 2(Core Course)			
Subject Code	15EE71	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain formulation of network models and bus admittance matrix for solving load flow problems. • To discuss solution of nonlinear static load flow equations by different numerical techniques and methods to control voltage profile. • To discuss optimal operation of generators on a bus bar, optimal unit commitment, reliability considerations and optimum generation scheduling. • To discuss optimal power flow solution, scheduling of hydro-thermal system, power system security and reliability. • To explain formulation of bus impedance matrix for the use in short circuit studies on power systems. • To explain numerical solution of swing equation for multi-machine stability. ■ 			
Module-1			Teaching Hours
Load Flow Studies: Introduction, Network Model Formulation, Formation of Y_{bus} by Singular Transformation, Load Flow Problem, Gauss-Seidel Method. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-2			
Load Flow Studies (continued): Newton-Raphson Method, Decoupled Load Flow Methods, Comparison of Load Flow Methods, Control of Voltage Profile. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-3			
Optimal System Operation: Introduction, Optimal Operation of Generators on a Bus Bar, Optimal Unit Commitment, Reliability Considerations, Optimum Generation Scheduling. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-4			
Optimal System Operation (continued): Optimal Load Flow Solution, Optimal Scheduling of Hydrothermal System, Power System Security, Maintenance Scheduling, Power System Reliability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-5			
Symmetrical Fault Analysis: Algorithm for Short Circuit Studies, Z_{bus} Formulation. Power System Stability: Numerical Solution of Swing Equation, Multimachine Stability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Formulate network matrices and models for solving load flow problems. • Perform steady state power flow analysis of power systems using numerical iterative techniques. • Suggest a method to control voltage profile. • Show knowledge of optimal operation of generators on a bus bar, optimal unit commitment, 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) 15EE71POWER SYSTEM ANALYSIS – 2(Core Subject) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Course outcomes(continued): <ul style="list-style-type: none"> • Discuss optimal scheduling for hydro-thermal system, power system security and reliability. • Analyze short circuit faults in power system networks using bus impedance matrix. • Perform numerical solution of swing equation for multi-machine stability■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks.Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Modern Power System Analysis	D. P. Kothari	McGraw Hill	4 th Edition, 2011
Reference Books				
1	Computer Methods in Power Systems Analysis	Glenn W Stagg Ahmed H Ei - Abiad	McGraw Hill	1stEdition, 1968
2	Computer Techniques in Power System Analysis	M.A. Pai	McGraw Hill	2ndEdition, 2006
3	Power System Analysis	HadiSaadat	McGraw Hill	2ndEdition, 2002

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
POWER SYSTEM PROTECTION(Core Subject)			
Subject Code	15EE72	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss performance of protective relays, components of protection scheme and relay terminology. • To explain relay construction and operating principles. • To explain Overcurrent protection using electromagnetic and static relays and Overcurrent protective schemes. • To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays. • To discuss pilot protection; wire pilot relaying and carrier pilot relaying. • To discuss construction, operating principles and performance of various differential relays for differential protection. • To discuss protection of generators, motors, Transformer and Bus Zone Protection. • To explain the principle of circuit interruption and different types of circuit breakers. • To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse. • To discuss protection Against Overvoltages and Gas Insulated Substation (GIS). ■ 			
Module-1			Teaching Hours
<p>Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.</p> <p>Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.</p> <p>Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Overcurrent Protection (continued): Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.</p> <p>Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges(Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection</p> <p>Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.</p> <p>Rotating Machines Protection: Introduction, Protection of Generators.</p> <p>Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE72 POWER SYSTEM PROTECTION (Core Course) (continued)				
Module-4				Teaching Hours
Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF ₆ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination. Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL). Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS). ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss performance of protective relays, components of protection scheme and relay terminology overcurrent protection. • Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays. • Discuss pilot protection; wire pilot relaying and carrier pilot relaying. • Discuss construction, operating principles and performance of differential relays for differential protection. • Discuss protection of generators, motors, Transformer and Bus Zone Protection. • Explain the principle of circuit interruption in different types of circuit breakers. • Describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse. • Discuss protection against Overvoltages and Gas Insulated Substation (GIS). ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbook				
1	Power System Protection and Switchgear	Badri Ram, D.N. Vishwakarma	McGraw Hill	2 nd Edition
2	Power System Protection and Switchgear (For additional study on gapless arrester, Refer to pages 458 to 461)	Bhuvanesh Oza et al	McGraw Hill	1 st Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE72 POWER SYSTEM PROTECTION (Core Course) (continued)				
Reference Books				
1	Protection and Switchgear	Bhavesht et al	Oxford	1 st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1 st Edition, 2009
3	Fundamentals of Power System Protection	Y.G.Paithankar S.R. Bhide	PHI	1 st Edition, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -VII			
HIGH VOLTAGE ENGINEERING (Core Course)			
Subject Code	15EE73	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss conduction and breakdown in gases, liquid dielectrics. • To discuss breakdown in solid dielectrics. • To discuss generation of high voltages and currents and their measurement. • To discuss overvoltage phenomenon and insulation coordination in electric power systems. • To discuss non-destructive testing of materials and electric apparatus. • To discuss high-voltage testing of electric apparatus ■ 			
Module-1			Teaching Hours
Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ , Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges. Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-3			
Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-4			
Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE73 HIGH VOLTAGE ENGINEERING (Core Course) (continued)				
Module-5 (continued)				Teaching Hours
High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain conduction and breakdown phenomenon in gases, liquid dielectrics. • Explain breakdown phenomenon in solid dielectrics. • Explain generation of high voltages and currents • Discuss measurement techniques for high voltages and currents. • Discuss overvoltage phenomenon and insulation coordination in electric power systems. • Discuss non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	High Voltage Engineering	M.S. Naidu, V.Kamaraju	McGraw Hill	5 th Edition, 2013.
Reference Books				
1	High Voltage Engineering Fundamentals	E. Kuffel, W.S. Zaengl, J. Kuffel	Newnes	2 nd Edition, 2000
2	High Voltage Engineering	Wadhwa C.L.	New Age International	3 rd Edition, 2012
3	High-Voltage Test and Measuring Techniques	Wolfgang Hauschild • Eberhard Lemke	Springer	1 st Edition 2014
4	High Voltage Engineering	Farouk A.M. Rizk	CRC Press	1 st Edition 2014

.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
UTILIZATION OF ELECTRICAL POWER(Professional Elective)			
Subject Code	15EE742	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss electric heating, air-conditioning and electric welding. • To explain laws of electrolysis, extraction and refining of metals and electro deposition. • To explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting • To discuss systems of electric traction, speed time curves and mechanics of train movement. • To discuss motors used for electric traction and their control. • To discuss braking of electric motors, traction systems and power supply and other traction systems. • Give awareness of technology of electric and hybrid electric vehicles. ■ 			
Module-1			Teaching Hours
Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques. Electrolytic Electro – Metallurgical Process: Ionization, Faraday’s Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, Electro Deposition. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion. Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor. Control of motors: Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes. Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC			08

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE742 UTILIZATION OF ELECTRICAL POWER(Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Traction, Feeding and Distribution System for Dc Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires. Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electric heating, air-conditioning and electric welding. • Explain laws of electrolysis, extraction and refining of metals and electro deposition. • Explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • Design interior and exterior lighting systems- illumination levels for factory lighting- flood lighting- street lighting. • Discuss systems of electric traction, speed time curves and mechanics of train movement. • Explain the motors used for electric traction and their control. • Discuss braking of electric motors, traction systems and power supply and other traction systems. • Explain the working of electric and hybrid electric vehicles. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, The Engineer and Society, Ethics, Individual and Team Work.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	A Textbook on Power System Engineering	A. Chakrabarti et al	Dhanpat Rai and Co	2 nd Edition, 2010
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5)	Mehrddad Ehsani et al	CRC Press	1 st Edition, 2005
Reference Books				
1	Utilization, Generation and Conservation of Electrical Energy	Sunil S Rao	Khanna Publishers	1 st Edition, 2011
2	Utilization of Electric Power and Electric Traction	G.C. Garg	Khanna Publishers	9 th Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS(Professional Elective)			
Subject Code	15EE752	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • Describe the process to plan, control and implement commissioning of electrical equipment's. • Differentiate the performance specifications of transformer and induction motor. • Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears. • Identification of tools and equipment's used for installation and maintenance of electrical equipment. • Explain the operation of an electrical equipment's such as isolators, circuit breakers, insulators and switchgears. ■ 			
Module-1			Teaching Hours
Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safety Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices. Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Test ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.		
Module-4			
Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handling Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
15EE752 TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Professional Elective) (continued)				
Module-5				Teaching Hours
<p>Switchgear and Protective Devices: Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.</p> <p>Domestic Installation: Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation ■</p>				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Describe the process to plan, control and implement commissioning of electrical equipment's. • Differentiate the performance specifications of transformer and induction motor. • Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears. • Describe corrective and preventive maintenance of electrical equipment's. • Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. ■ 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/ Reference Books				
1	Testing, Commissioning, Operation and Maintenance of Electrical Equipment	S. Rao	Khanna Publishers	6 th Edition, 19 th Reprint, 2015
2	Testing and Commissioning of Electrical Equipment	R.L.Chakrasali	Prism Books Pvt Ltd	1 st Edition, 2014
3	Preventive Maintenance of Electrical Apparatus	S.K.Sharotri	Katson Publishing House	1 st Edition, 1980
4	Handbook of Switchgears	BHEL	McGraw Hill	1 st Edition, 2005
5	Transformers	BHEL	McGraw Hill	1 st Edition, 2003
6	TheJ&P Transformer Book	Martin J. Heathcote	Newnes	12 th Edition, 1998

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VII			
POWER SYSTEM SIMULATION LABORATORY			
Subject Code	15EEL76	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain the use of MATLAB package to assess the performance of medium and long transmission lines. • To explain the use of MATLAB package to obtain the power angle characteristics of salient and non-salient pole alternator. • To explain the use of MATLAB package to study transient stability of radial power systems under three phase fault conditions. • To explain the use of MATLAB package to develop admittance and impedance matrices of interconnected power systems. • To explain the use of Mi-Power package to solve power flow problem for simple power systems. • To explain the use of Mi-Power package to perform fault studies for simple radial power systems. • To explain the use of Mi-Power package to study optimal generation scheduling problems for thermal power plants. ■ 			
Sl. No	Experiments		
1	Use of MATLAB package	Formation for symmetric π /T configuration for Verification of $AD - BC = 1$, Determination of Efficiency and Regulation.	
2		Determination of Power Angle Diagrams, Reluctance Power, Excitation, Emf and Regulation for Salient and Non-Salient Pole Synchronous Machines.	
3		To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.	
4		Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation and Inspection Method.	
5		Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm.	
6		Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage (Bus) Profile.	
7	Use of Mi-Power package	Formation of Jacobian for a System not Exceeding 4 Buses (No PV Buses) in Polar Coordinates.	
8		Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses.	
9		To Determine Fault Currents and Voltages in a Single Transmission Line System with Star-Delta Transformers at a Specified Location for LG and LLG faults by simulation.	
10		Optimal Generation Scheduling for Thermal power plants by simulation.	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Develop a program in MATLAB to assess the performance of medium and long transmission lines. • Develop a program in MATLAB to obtain the power angle characteristics of salient and non-salient pole alternator. • Develop a program in MATLAB to assess the transient stability under three phase fault at different locations in a of radial power systems. • Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems. • Use Mi-Power package to solve power flow problem for simple power systems. • Use Mi-Power package to study unsymmetrical faults at different locations in radial power systems • Use of Mi-Power package to study optimal generation scheduling problems for thermal power plants. ■ 			

<p style="text-align: center;">B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII</p>
<p style="text-align: center;">15EEL76POWER SYSTEM SIMULATION LABORATORY (continued)</p>
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none">1. All laboratory experiments are to be included for practical examination.2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.3. Students can pick one experiment from the questions lot prepared by the examiners.4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII			
RELY AND HIGH VOLTAGE LABORATORY			
Subject Code	15EEL77	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	42	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type. • To verify the operation of negative sequence relay. • To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay. • To conduct experiments on generator, motor and feeder protection. • To conduct experiments to study the sparkover characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • To measure high AC and DC voltages • To experimentally measure the breakdown strength of transformer oil. • To experimentally measure the capacitance of different electrode configuration models using Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■ 			
Sl. NO	Experiments		
Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. The experiments under Part – D is compulsory.			
1	Part - A	Over Current Relay: (a) Inverse Definite Minimum Time (IDMT) Non-Directional Characteristics (b) Directional Features (c) IDMT Directional.	
2		IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).	
3		Operation of Negative Sequence Relay.	
4	Part - B	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.	
5		Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.	
6		Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage Relay.	
7	Part - C	Generation Protection: Merz Price Scheme.	
8		Feeder Protection against Faults.	
9		Motor Protection against Faults.	
10	Part - D	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS 1876: 2005] and Non-uniform [as per IS 2071 (Part 1) : 1993] Configurations: Sphere – Sphere, Point – Plane, Point – Point and Plane – Plane.	
11		Spark Over Characteristics of Air subjected to High voltage DC.	
12		Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005	
13		Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005	
14		Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/ Transmission Line/ Sphere Gap.	
15		(a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.	
15			
Revised Bloom's Taxonomy Level		L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII
15EEL77 RELY AND HIGH VOLTAGE LABORATORY (continued)
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Experimentally verify the characteristics of over current, over voltage, under voltage and negative sequence relays both electromagnetic and static type. • Experimentally verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay. • Show knowledge of protecting generator, motor and feeders. • Analyze the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • Measure high AC and DC voltages and breakdown strength of transformer oil. • Draw electric field and measure the capacitance of different electrode configuration models. • Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■
<p>Graduate Attributes (As per NBA)</p> <p>Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII			
PROJECT PHASE – I AND SEMINAR			
Subject Code	15EEP78	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 02			
<p>Course objectives:</p> <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. • Demonstrate the knowledge, skills and attitudes of a professional engineer. ■ 			
<p>Graduate Attributes (As per NBA)</p> <p>Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>			
<p>Continuous Internal Evaluation</p> <p>CIE marks for the project report (50 marks) and seminar (50 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■</p>			

**** END ****

VIII SEMESTER DETAILED SYLLABUS

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII			
POWER SYSTEM OPERATION AND CONTROL(Core Course)			
Subject Code	15EE81	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To describe various levels of controls in power systems and the vulnerability of the system. • To explain components, architecture and configuration of SCADA. • To define unit commitment and explain various constraints in unit commitment and the solution methods • To explain issues of hydrothermal scheduling and solutions to hydro thermal problems • To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control • To explain automatic generation control, voltage and reactive power control in an interconnected power system. • To explain reliability and contingency analysis, state estimation and related issues. ■ 			
Module-1			Teaching Hours
Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centres. Supervisory Control and Data acquisition (SCADA): Introduction to SCADA and its Components, Standard SCADA Configurations, Users of Power Systems SCADA, Remote Terminal Unit for Power System SCADA, Common Communication Channels for SCADA in Power Systems, Challenges for Implementation of SCADA. Unit Commitment: Introduction, Simple Enumeration Constraints, Priority List Method, Dynamic Programming Method for Unit Commitment. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Hydro-thermal Scheduling: Introduction, Scheduling Hydro Systems, Discrete Time Interval Method, Short Term Hydro Thermal Scheduling Using $\gamma - \lambda$ Iterations, Short Term Hydro Thermal Scheduling Using Penalty Factors. Automatic Generation Control (AGC): Introductions, Basic Generator Control Loops, Commonly used Terms in AGC, Functions of AGC, Speed Governors. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Automatic Generation Control (continued): Mathematical Model of Automatic Load Frequency Control, AGC Controller, Proportional Integral Controller. Automatic Generation Control in interconnected Power system: Introductions, Tie - Line Control with Primary Speed Control, Frequency Bias Tie - Line Control, State-Space Models. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
Automatic Generation Control in interconnected Power system (continued): State-Space Model for Two - Area System, Tie-Line Oscillations, Related Issues in Implementation of AGC. Voltage and Reactive Power Control: Introduction, Production and Absorption of Reactive Power, Methods of Voltage Control, Dependence of Voltage on Reactive Power, Sensitivity of Voltage to Changes in P And Q, Cost Saving, Methods of Voltage Control by Reactive Power Injection, Voltage Control Using Transformers, Voltage Stability. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
15EE81POWER SYSTEM OPERATION AND CONTROL(Core Course) (continued)				
Module-5				Teaching Hours
<p>Power System Reliability and Security: Introduction, Security Levels of System, Reliability Cost, Adequacy Indices, Functions of System Security, Contingency Analysis, Linear Sensitivity Factors, Contingency Selection and Ranking.</p> <p>State estimation of Power Systems: Introduction, Linear Least Square Estimation, DC State Estimator, Other Issues in State Estimation. ■</p>				10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA. • Solve unit commitment problems • Explain issues of hydrothermal scheduling and solutions to hydro thermal problems • Explain basic generator control loops, functions of Automatic generation control, speed governors • Develop and analyze mathematical models of Automatic Load Frequency Control • Explain automatic generation control, voltage and reactive power control in an interconnected power system. • Explain reliability, security, contingency analysis, state estimation and related issues of power systems. ■ 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Communication, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Power System Operation and Control	K. Uma Rao	Wiley	1 st Edition, 2012
Reference Books				
1	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition, 2003
2	Power System Stability and Control	Kundur	McGraw Hill	8 th Reprint, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII			
INDUSTRIAL DRIVES AND APPLICATIONS(Core Course)			
Subject Code	15EE82	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define electric drive, its parts, advantages and explain choice of electric drive. • To explain dynamics and modes of operation of electric drives. • To explain selection of motor power ratings and control of dc motor using rectifiers. • To analyze the performance of induction motor drives under different conditions. • To explain the control of induction motor, synchronous motor and stepper motor drives. • To discuss typical applications electrical drives in the industry. ■ 			
Module-1			Teaching Hours
Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Selection of Motor Power Ratings: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating. Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed From Fully Controlled Rectifier, Rectifier Control of dc Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited dc Motor, Chopper Control of Series Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques- Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors. Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII				
15EE82 INDUSTRIAL DRIVES AND APPLICATIONS(Core Course) (continued)				
Module-5				Teaching Hours
Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless dc Motor Drives. Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. Industrial Drives: Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the advantages and choice of electric drive. • Explain dynamics and different modes of operation of electric drives. • Suggest a motor for a drive and control of dc motor using controlled rectifiers. • Analyze the performance of induction motor drives under different conditions. • Control induction motor, synchronous motor and stepper motor drives. • Suggest a suitable electrical drive for specific application in the industry. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. 				
Textbook				
1	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing House	2 nd Edition, 2001
2	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives under module 5.)	VedumSubrahmanyam	McGraw Hill	2 nd Edition, 2011
Reference Books				
1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1 st Edition, 2009

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER -VIII			
INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)			
Subject Code	15EE833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain power generation by alternate energy source like wind power and solar power. • To explain selection of size of units and location for wind and solar systems. • Discuss the effects of integration of distributed generation on the performance the system. • To provide practical and useful information about grid integration of distributed generation. ■ 			
Module-1			Teaching Hours
Distributed Generation: Introduction,Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Overloading and Losses(continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Power Quality Disturbances (continued): Low-Frequency Harmonics, High-Frequency Distortion, Voltage Dips, Increasing the Hosting Capacity. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Explain energy generation by wind power and solar power. • Discuss the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems. 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
15EE833 INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)(continued)				
Course outcomes (continued):				
<ul style="list-style-type: none"> • Explain the performance of the system when distributed generation is integrated to the system. • Discuss effects of the integration of DG: the increased risk of overload and increased losses. • Discuss effects of the integration of DG: increased risk of overvoltages, increased levels of power quality disturbances. • Discuss effects of the integration of DG: incorrect operation of the protection • Discuss the impact the integration of DG on power system stability and operation. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, The Engineer and Society, Ethics, Individual and Team Work, Communication, Project Management and Finance, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Integration of Distributed Generation in the Power System	Math Bollen	Wiley	2011

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII			
INTERNSHIP / PROFESSIONAL PRACTICE			
Subject Code	15EE84	IA Marks	50
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	50
Credits - 02			
<p>Course objectives: Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <ul style="list-style-type: none"> • To put theory into practice. • To expand thinking and broaden the knowledge and skills acquired through course work in the field. • To relate to, interact with, and learn from current professionals in the field. • To gain a greater understanding of the duties and responsibilities of a professional. • To understand and adhere to professional standards in the field. • To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. • To identify personal strengths and weaknesses. • To develop the initiative and motivation to be a self-starter and work independently. ■ 			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p>Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. • Expand intellectual capacity, credibility, judgment, intuition. • Acquire the knowledge of administration, marketing, finance and economics. ■ 			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - VIII**

15EE84INTERNSHIP / PROFESSIONAL PRACTICE(continued)

Continuous Internal Evaluation

CIE marks for the Internship/Professional practicerreport (25 marks)and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

Semester End Examination

SEE marks for the project report (25 marks)and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII			
PROJECT WORK PHASE -II			
Subject Code	15EEP85	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	100
Credits - 06			
Course objectives:			
<ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			
Evaluation Procedure:			
The Internal marks evaluation shall be based on project report and presentation of the same in a seminar.			
Project Report: 50 marks. The basis for awarding the marks shall be the involvement of individual student of the project batch in carrying the project and preparation of project report. To be awarded by the internal guide in consultation with external guide if any.			
Project Presentation: 50 marks. Each student of the project batch shall present the topic of Project Work Phase - II orally and/or through power point slides.			
The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.			
The student shall be evaluated based on:			
Presentation skill for 30 marks and ability in the Question and Answer session for 20 marks. ■			
Semester End Examination			
SEE marks for the project (100 marks)shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) as per the University norms by the examiners appointed VTU. ■			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - VIII			
SEMINAR			
Subject Code	15EES86	IA Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 01			
<p>Course objectives: The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.</p> <ul style="list-style-type: none"> • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Attain, use and develop knowledge in the field of electrical and electronics engineering and other disciplines through independent learning and collaborative study. • Identify, understand and discuss current, real-time issues • Improve oral and written communication skills • Explore an appreciation of the self in relation to its larger diverse social and academic contexts. • Apply principles of ethics and respect in interaction with others. ■ 			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			
<p>Evaluation Procedure: The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman.</p> <p>Marks distribution for internal assessment of the course 15EES86 seminar: Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks. ■</p>			



VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2017-2018

Choice Based Credit System (CBCS)

**B.E: ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)**

III SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics-III (Core)	Mathematics	04		03	60	40	100	4
2	17EE32	Electric Circuit Analysis (Core)	EEE	04		03	60	40	100	4
3	17EE33	Transformers and Generators (Core)	EEE	04		03	60	40	100	4
4	17EE34	Analog Electronic Circuits (Core)	EEE	04		03	60	40	100	4
5	17EE35	Digital System Design (Core)	EEE	04		03	60	40	100	4
6	17EE36	Electrical and Electronic Measurements (Foundation course)	EEE	03		03	60	40	100	3
7	17EEL37	Electrical Machines Laboratory -1	EEE	01- Hour Instruction 02- Hour Practical		03	60	40	100	2
8	17EEL38	Electronics Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2. Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

1	17MATDIP31	Additional Mathematics –I	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

IV SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics-IV (Core)	Mathematics	04		03	60	40	100	4
2	17EE42	Power Generation and Economics (Core)	EEE	04		03	60	40	100	4
3	17EE43	Transmission and Distribution (Core)	EEE	04		03	60	40	100	4
4	17EE44	Electric Motors (Core)	EEE	04		03	60	40	100	4
5	17EE45	Electromagnetic Field Theory (Core)	EEE	04		03	60	40	100	4
6	17EE46	Operational Amplifiers and Linear ICs (Foundation course)	EEE	03		03	60	40	100	3
7	17EEL47	Electrical Machines Laboratory -2	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17EEL48	Op- amp and Linear ICs Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01		01	30	20	50	01
TOTAL				Theory: 24hours Practical: 06 hours		25	510	340	850	28

1. Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

2.Audit Course:

(i) *All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – II, which is 03 contact hours per week.

1	17MATDIP41	Additional Mathematics –II	Maths	03		03	60	--	60	--
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(ii) Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examination 2017-2018

Choice Based Credit System (CBCS)

B.E: ELECTRICAL AND ELECTRONICS ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

V SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EE51	Management and Entrepreneurship	EEE	04		03	60	40	100	4
2	17EE52	Microcontroller(Core)	EEE	04		03	60	40	100	4
3	17EE53	Power Electronics(Core)	EEE	04		03	60	40	100	4
4	17EE54	Signals and Systems(Core)	EEE	04		03	60	40	100	4
5	17EE55X	Professional Elective – I	EEE	03		03	60	40	100	3
6	17EE56Y	Open Elective - I	EEE	03		03	60	40	100	3
7	17EEL57	Microcontroller Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17EEL58	Power Electronics Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	60	40	100	2
TOTAL				Theory: 22hours Practical: 06 hours		24	480	320	800	26

Professional Elective-1		Open Elective – 1*** (List offered by EEE Board only)	
17EE551	Introduction to Nuclear Power	17EE561	Electronic Communication systems
17EE552	Electrical Engineering Materials	17EE562	Programmable Logic controllers
17EE553	Estimating and Costing	17EE563	Renewable Energy Systems
17EE554	Special Electrical Machines	17EE564	Business Communication

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre –requisiteknowledge.
- The candidate has studied similar content course during previous semesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied Professional elective(s).

Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)
B.E: ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VI SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EE61	Control Systems(Core)	EEE	04		03	60	40	100	4
2	17EE62	Power System Analysis – 1(Core)	EEE	04		03	60	40	100	4
3	17EE63	Digital Signal Processing(Core)	EEE	04		03	60	40	100	4
4	17EE64	Electrical Machine Design(Core)	EEE	04		03	60	40	100	4
5	17EE65X	Professional Elective – II	EEE	03		03	60	40	100	3
6	17EE66Y	Open Elective - II	EEE	03		03	60	40	100	3
7	17EEL67	Control System Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	60	40	100	2
8	17EEL68	Digital Signal Processing Laboratory	EEE	01- Hour Instruction 02- Hour Practical		03	60	40	100	2
TOTAL				Theory:22hours Practical: 06 hours		Core Course	480	320	800	26

Professional Elective-2		Open Elective – 2*** (List offered by EEE Board only)	
17EE651	Computer Aided Electrical Drawing	17EE661	Artificial Neural Networks and Fuzzy logic
17EE652	Advanced Power Electronics	17EE662	Sensors and Transducers
17EE653	Energy Audit and Demand side Management	17EE663	Batteries and Fuel Cells for Commercial, Military and Space Applications
17EE654	Solar and Wind Energy	17EE664	Industrial Servo Control Systems

***Students can select any one of the open electives offered by any Department (Please refer to consolidated list of VTU for open electives).

Selection of an open elective is not allowed, if:

- The candidate has no pre –requisiteknowledge.
- The candidate has studied similar content course during previoussemesters.
- The syllabus content of the selected open elective is similar to that of Departmental core course(s) or to be studied as Professional elective(s).
- A similar course, under any category, is prescribed in the higher semesters.

Registration to open electives shall be documented under the guidance of Programme Coordinator and Adviser.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EE71	Power System Analysis – 2(Core)	EEE	04		03	60	40	100	4
2	17EE72	Power System Protection(Core)	EEE	04		03	60	40	100	4
3	17EE73	High Voltage Engineering(Core)	EEE	04		03	60	40	100	4
4	17EE74X	Professional Elective – III	EEE	03		03	60	40	100	3
5	17EE75Y	Professional Elective – IV	EEE	03		03	60	40	100	3
6	17EEL76	Power system Simulation Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
7	17EEL77	Rely and High Voltage Laboratory	EEE	01-Hour Instruction 02-Hour Practical		03	60	40	100	2
8	17EEP78	Project Work Phase–I + Project work Seminar	EEE		03	--	--	100	100	2
TOTAL				Theory:18 hours Practical and Project: 09 hours		21	420	380	800	24

Professional Elective-3		Professional Elective-4	
17EE741	Advanced Control Systems	17EE751	FACTs and HVDC Transmission
17EE742	Utilization of Electrical Power	17EE752	Testing and Commissioning of Power System Apparatus
17EE743	Carbon Capture and Storage	17EE753	Spacecraft Power Technologies
17EE744	Power System Planning	17EE754	Industrial Heating

1. Project Phase – I and Project Seminar: Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and Seminar presentation skill.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2017-2018
Choice Based Credit System (CBCS)

B.E: ELECTRICAL AND ELECTRONICS ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

VIII SEMESTER

Sl. No	Course Code	Title	Teaching Department	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Drawing	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	17EE81	Power System Operation and Control (Core)	EEE	4	-	3	60	40	100	4
2	17EE82	Industrial Drives and Applications(Core)	EEE	4	-	3	60	40	100	4
3	17EE83X	Professional Elective-5	EEE	3	-	3	60	40	100	3
4	17EE84	Internship/ Professional Practice (Core)	EEE	Industry Oriented		3	50	50	100	2
5	17EEP85	Project Work-II(Core)	EEE	-	6	3	100	100	200	6
6	17EES86	Seminar (Core)	EEE	-	4	-	-	100	100	1
TOTAL				Theory: 11 hours Project and Seminar: 10 hours		15	330	370	700	20

Professional Elective -5	
17EE831	Smart Grid
17EE832	Operation and Maintenance of Solar Electric Systems
17EE833	Integration of Distributed Generation
17EE834	Power System in Emergencies

1. Internship/ Professional Practice: 4 Weeks internship to be completed between the (VI and VII semester vacation) and/or (VII and VIII semester vacation) period.

III SEMESTER DETAILED SYLLABUS

ENGINEERING MATHEMATICS –III (Core Course) B.E., III Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17MAT31	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to learn Fourier series, Fourier transforms and Z-transforms, statistical methods , numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variations. 			
Module-1			Teaching Hours
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transform. Z-transform: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Statistical Methods: Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form, Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula-Falsi Method and Newton-Raphson method.			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems. Numerical integration: Simpson's (1/3) th and (3/8) th rules, Weddle's rule (without proof) – Problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-5			
Vector integration: Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss-divergence theorem(without proof) and problems. Calculus of Variations: Variation of function and Functional, variational problems. Euler's equation, Geodesics, hanging chain, problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III				
17MAT31 ENGINEERING MATHEMATICS –III (Core Subject) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Know the use of periodic signals and Fourier series to analyze circuits and system communications. • Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform. • Employ appropriate numerical methods to solve algebraic and transcendentalequations. • Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flowproblems. • Determine the extremals of functional and solve the simple problems of the calculus of variations. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Text Books				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	2006
5	Higher Engineering Mathematics	H. K.DassEr. Rajnish Verma	S.Chand	First Edition, 2011
Web links and Video Lectures: 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math				

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRIC CIRCUIT ANALYSIS (Core Subject)			
Subject Code	17EE32	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To familiarize the basic laws, source transformations, theorems and the methods of analysing electrical circuits. • To explain the use of network theorems and the concept of resonance. • To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs. • To explain the importance of initial conditions, their evaluation and transient analysis of R-L and R-C circuits. • To impart basic knowledge on network analysis using Laplace transforms. 			
Module-1			Teaching Hours
Basic Concepts: Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super-Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources. Duality. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Network Theorems: Super Position theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem. Analysis of networks, with and without dependent ac and dc sources. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance Transient Analysis: Transient analysis of RL and RC circuits under dc and ac excitations: Behaviour of circuit elements under switching action ($t = 0$ and $t = \infty$), Evaluation of initial conditions.			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Unbalanced Three phase systems: Analysis of three phase systems, calculation of real and reactive powers. Two Port networks: Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits.			10

Course outcomes:

At the end of the course the student will be able to:

- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks.
- Reduce the complexity of network using source shifting, source transformation and network reduction using transformations.
- Solve complex electric circuits using network theorems.
- Discuss resonance in series and parallel circuits.
- Discuss the importance of initial conditions and their evaluation.
- Synthesize typical waveforms using Laplace transformation.
- Solve unbalanced three phase systems.
- Evaluate the performance of two port networks ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Engineering Circuit Analysis	William H Hayt et al	Mc Graw Hill	8th Edition, 2014
2	Network Analysis	M.E. Vanvalkenburg	Pearson	3rd Edition, 2014
3	Fundamentals of Electric Circuits	Charles K Alexander Matthew N O Sadiku	Mc Graw Hill	5th Edition, 2013

Reference Books

4	Engineering Circuit Analysis	J David Irwin et al	Wiley India	10th Edition, 2014
5	Electric Circuits	Mahmood Nahvi	Mc Graw Hill	5th Edition, 2009
6	Introduction to Electric Circuits	Richard C Dorf and James A Svoboda	Wiley	9 th Edition, 2015
7	Circuit Analysis; Theory and Practice	Allan H Robbins Wilhelm C Miller	Cengage	5 th Edition, 2013

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
TRANSFORMERS AND GENERATORS (Core Course)			
Subject Code	17EE33	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To understand the concepts of transformers and their analysis. • To suggest a suitable three phase transformer connection for a particular operation. • To understand the concepts of generator and to evaluate their performance. • To explain the requirement for the parallel operation of transformers and synchronous generators. 			
Module-1			Teaching Hours
<p>Single phase Transformers: Operation of practical transformer under no - load and on - load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency- commercial and all-day. Voltage regulation and its significance.</p> <p>Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>(Transformers contd): Polarity test, Sumpner's test.</p> <p>Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase. Load sharing in case of similar and dissimilar transformers.</p> <p>Autotransformers and Tap changing transformers: Introduction to auto transformer - copper economy, equivalent circuit, no load and on load tap changing transformers</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>(Transformers continued) Tertiary winding Transformers: Necessity of tertiary winding, equivalent circuit and voltage regulation, tertiary winding in star/star transformers, rating of tertiary winding.</p> <p>Direct current Generator: Armature reaction, Commutation and associated problems,</p> <p>Synchronous generators: Armature windings, winding factors, e.m.f equation. Harmonics – causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing,		
Module-4			

Synchronous generators (continuation): Generator load characteristic. Voltage regulation, excitation control for constant terminal voltage. Generator input and output. Parallel operation of generators and load sharing. Synchronous generator on infinite bus-bars – General load diagram, Electrical load diagram and V – curves. Power angle characteristic and synchronizing power. Effects of saliency, two-reaction theory, Direct and Quadrature reactance, power angle diagram, reluctance power, slip test. ■		10		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Synchronous generators (continuation): Open circuit and short circuit characteristics, Assessment of reactance- short circuit ratio, synchronous reactance, adjusted synchronous reactance and Potier reactance. Voltage regulation by EMF, MMF, ZPF methods. Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators. Starting, synchronizing and control. Hunting and dampers. ■		10		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the construction and operation and performance of single phase and three phase transformers. • Explain the use of auto transformer, tap changing and tertiary winding transformer and need of operating transformers in parallel. • Explain the armature reaction and commutation and their effects in a DC generators. • Explain the construction, operation and performance of Synchronous machines. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Books				
1	Electric Machines	D. P. Kothari, et al	McGraw Hill	4 th Edition, 2011
2	Performance and Design of A.C. Machines	M. G. Say	CBS Publishers	3 rd Edition, 2002
Reference Books				
3	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2 nd Edition, 2013
4	Electric Machines	Mulukunta S. Sarma, et al	Cengage	1 st Edition, 2009
5	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6 th Edition, 2014
6	Electrical Machines	M.V. Deshpande	PHI	1 st Edition, 2013
7	Electrical Machines	Abhijit Chakrabarti et al	McGraw Hill	1 st Edition, 2015
8	A Textbook of Electrical Machines	K.R.Siddapura D.B.Raval	Vikas	1 st Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
ANALOG ELECTRONIC CIRCUITS (Core Course)			
Subject Code	17EE34	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Provide the knowledge for the analysis of diode and transistor circuits. • Develop skills to design the electronic circuits like amplifiers and oscillators. 			
Module-1			Teaching Hours
Diode Circuits: Diode clipping and clamping circuits. Transistor biasing and stabilization: Operating point, analysis and design of fixed bias circuit, self-bias circuit, Emitter stabilized bias circuit, voltage divider bias circuit, stability factor of different biasing circuits. Problems. Transistor switching circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-2			
Transistor at low frequencies: BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model, relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual.			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
Multistage amplifiers: Cascade and cascode connections, Darlington circuits, analysis and design. Feedback amplifiers: Feedback concept, different types, practical feedback circuits, analysis and design of feedback circuits. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Power amplifiers: Amplifier types, analysis and design of different power amplifiers, Oscillators: Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
FETs: Construction, working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET. Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

Course outcomes:

At the end of the course the student will be able to:

- Predict the output response of clipper and clamper circuits.
- Design and compare biasing circuits for transistor amplifiers
- Explain the transistor switching.
- Explain the concept of feedback, its types and design of feedback circuits
- Design and analyze the power amplifier circuits and oscillators for different frequencies.
- Perform design and analysis of FET and MOSFET amplifiers in the common source mode with fixed bias. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015
2		Millman and Halkias		
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008

Reference Books

4	Microelectronics Circuits Analysis and Design	Muhammad Rashid	Cengage Learning	2 nd Edition, 2014
5	A Text Book of Electrical Technology, Electronic Devices and Circuits	B.L. Theraja, A.K. Theraja,	S. Chand	Reprint, 2013
6	Electronic Devices and Circuits	Anil K. Maini Vasha Agarval	Wiley	1st Edition, 2009
7	Electronic Devices and Circuits	S.Salivahanan N.Suresh	Mc Graw Hill	3rd Edition, 2013
8	Fundamentals of Analog Circuits	Thomas L Floyd	Pearson	2nd Edition, 2012

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - III			
DIGITAL SYSTEM DESIGN(Core Course)			
Subject Code	17EE35	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of combinational circuit design. • To impart the knowledge of Sequential circuit design. • To provide the basic knowledge about VHDL & its use. 			
Module-1			Teaching Hours
Principles of combinational logic: Definition of combinational, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. Incompletely specified functions (Don't care terms). Simplifying max - term equations. Quine -McClusky minimization technique, Quine - McClusky using don't care terms, Reduced Prime Implicant tables.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Analysis and design of Combinational Logic: General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-using multiplexers as Boolean function generators. Adders and Subtractors-Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Sequential Circuits: Basic Bistable element, Latches, SR latch, application of SR latch, A Switch debouncer, The gated SR latch. The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The master-slave SR Flip-Flops, The master-slave JK Flip-Flop. Characteristic equations, Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 counters using clocked JK Flip-Flops Design of a Synchronous Mod-6 counter using clocked D, T, or SR Flip-Flops.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Sequential Design: Introduction, Mealy and Moore models, State machine notation, synchronous sequential circuit analysis and design. Construction of state Diagrams, Counters Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions (only VHDL), Simulation and synthesis, Brief comparison of VHDL and Verilog. Data-Flow Descriptions: Highlights of Data flow descriptions, Structure of data-flow description,.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

Course outcomes:

At the end of the course the student will be able to:

- Simplify switching equations generated from truth tables.
- Design combinational logic circuits; adders, Subtractors and comparators.
- Design synchronous sequential circuits; latches, flip-flops, binary counters and Mod – 6 counters.
- Design Mealy and Moore synchronous sequential circuit models.
- Construct state diagrams for sequential circuits.
- Describe the structure of HDL module, operators, data types.
- Give Comparison between VHDL and Verilog.
- Understand the concept of data-flow description.

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books

1	Digital Logic Applications and	John M Yarbrough	CengageLearn	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill	1 st Edition, 2002

Reference Books

3	Logic and computer design Fundamentals	M. Morries Mano and Charles Kime	Pearson Learning	4 th Edition, 2014
4	Fundamentals of logic design	Charles H Roth, JR and Larry L. Kinney	Cengage Learning	6 th Edition, 2013
5	Fundamentals of Digital Circuits	A. Anand Kumar	PHI	3 rd Edition, 2014
6	Digital Logic Design and VHDL	A.A.Phadke, S.M.Deokar	Wiley India	1 st Edition, 2009
7	Digital Circuits and Design	D.P.Kothari J.S.Dhillon	Pearson	First Print 2015
8	HDL Programming (VHDL and Verilog)	Nazeih M. Botros	Cengage Learning	1 st Edition, 2011
9	Circuit Design and Simulation with VHDL	Volnei A Pedroni	PHI	2 nd Edition,

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course)			
Subject Code	17EE36	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To measure resistance, inductance and capacitance using different bridges and determine earth resistance. • To study the construction and working of various meters used for measurement. • To study the adjustments, calibration & errors in energy meters and methods of extending the range of instruments. 			
Module-1			Teaching Hours
Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. Measurement of Inductance and Capacitance: Sources and detectors. Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Measurement of Power, Energy, Power factor and Frequency: Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Extension of Instrument Ranges: Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characterises, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT. Magnetic measurements: Introduction, measurement of flux/ flux density, magnetising force and leakage factor.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electronic and digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (with block diagram), extra features offered by present day meters and their significance in billing.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

Module-5				Teaching Hours
Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. Recording Devices: Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders. Digital tape recording, Ultraviolet recorders. Electro Cardio Graph (ECG) ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Measure resistance, inductance and capacitance using bridges and determine earth resistance. • Explain the working of various meters used for measurement of Power & Energy. • Understand the adjustments, calibration & errors in energy meters & also methods of extending the range of instruments & instrument transformers. • Explain the working of different electronic instruments, display devices and recording mechanisms. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Books				
1	Electrical and electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai and Co	10th Edition
2	A Course in Electronics and Electrical Measurements and Instrumentation	J. B. Gupta	Katson Books	2013 Edition
Reference Books				
3	Electrical and electronic Measurements and Instrumentation	Er.R.K. Rajput	S Chand	5th Edition, 2012
4	Electrical Measuring Instruments and Measurements	S.C. Bhargava	BS Publications	2013
5	Modern Electronic Instrumentation and Measuring Techniques	Cooper D and A.D. Heifrick	Pearson	First Edition, 2015
6	Electronic Instrumentation and Measurements	David A Bell	Oxford University	3rd Edition, 2013
7	Electronic Instrumentation	H.S.Kalsi	Mc Graw Hill	3rd Edition, 2010

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III			
ELECTRICAL MACHINES LABORATORY - 1			
Subject Code	17EEL37	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory	SEE Marks	60
Total Number of Practical Hours	42	Exam Hours	03
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • Conducting of different tests on transformers and synchronous machines and evaluation of their performance. • Verify the parallel operation of two single phasetransformers. • Study the connection of single phase transformers for three phase operation and phase conversion. • Study of synchronous generator connected to infinitebus. ■ 			
Sl. NO	Experiments		
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.		
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.		
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.		
4	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.		
5	Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.		
6	Scott connection with balanced and unbalanced loads.		
7	Separation of hysteresis and eddy current losses in single phase transformer.		
8	Voltage regulation of an alternator by EMF and MMF methods.		
9	Voltage regulation of an alternator by ZPF method.		
10	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.		
11	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.		
12	Power angle curve of synchronous generator.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Evaluate the performance of transformers from the test dataobtained. • Connect and operate two single phase transformers of different KVA rating in parallel. • Connect single phase transformers for three phase operation and phase conversion. • Compute the voltage regulation of synchronous generator using the test data obtained in thelaboratory. • Evaluate the performance of synchronous generators from the test data. 			

- Assess the performance of synchronous generator connected to infinite bus.

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - III ELECTRONICS LABORATORY			
Subject Code	17EEL38	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Practical Hours	42	Exam Hours	03
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To design and test half wave and full wave rectifier circuits. • To design and test different amplifier and oscillator circuits using BJT. • To study the simplification of Boolean expressions using logic gates. • To realize different Adders and Subtractors circuits. • To design and test counters and sequence generators. 			
Sl. No	Experiments		
1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.		
2	Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.		
3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.		
4	Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.		
5	Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.		
6	Simplification, realization of Boolean expressions using logic gates/Universal gates.		
7	Realization of half/Full adder and Half/Full Subtractors using logic gates.		
8	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion and Vice - Versa.		
9	Realization of Binary to Gray code conversion and vice versa.		
10	Design and testing Ring counter/Johnson counter.		
11	Design and testing of Sequence generator.		
12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192, 74193.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Design and test rectifier circuits with and without capacitor filters. • Determine h-parameter models of transistor for all modes. • Design and test BJT and FET amplifier and oscillator circuits. • Realize Boolean expressions, adders and subtractors using gates. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

IV SEMESTER DETAILED SYLLABUS

ENGINEERING MATHEMATICS –IV (Core Subject) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17MAT41	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course Objectives: The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering. ■			
Module-1			Teaching Hours
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's method, Runge - Kutta method of fourth order. Milne's and Adams-Bashforth predictor and corrector methods (No derivations or formulae). ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta method and Milne's method. Special Functions: Series solution-Frobenius method. Series solution of Bessel's differential equation leading to J _n (x)-Bessel's function of first kind. Basic properties, recurrence relations and orthogonality. Series solution of Legendre's differential equation leading to P _n (x)-Legendre polynomials. Rodrigue's formula, problems. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Complex Variables: Review of a function of a complex variable, limits, continuity, differentiability. Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral formula, Residue, poles, Cauchy's Residue theorem (without proof) and problems. Transformations: Conformal transformations, discussion of transformations: $w = z^2, w = e^z, w = z + (1/z) (z \neq 0)$ and bilinear transformations-problems. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-4			
Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems. Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-5			
Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
17MAT41 ENGINEERING MATHEMATICS – IV (Core Subject) (continued)				
Course outcomes:				
<ul style="list-style-type: none"> • Use appropriate single step and multi-step numerical methods to solve first and second order ordinary differential equations arising in flow data design problems. • Explain the idea of analyticity, potential fields residues and poles of complex potentials in field theory and electromagnetic theory. • Employ Bessel's functions and Legendre's polynomials for tackling problems arising in continuum mechanics, hydrodynamics and heat conduction. • Describe random variables and probability distributions using rigorous statistical methods to analyze problems associated with optimization of digital circuits, information, coding theory and stability analysis of systems. • Apply the knowledge of joint probability distributions and Markov chains in attempting engineering problems for feasible random events. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Text Books:				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
Reference books:				
3	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publishers	7 th Edition, 2010
4	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	2006
5	Higher Engineering Mathematics	H. K. Dass and Er. Rajnish Verma	S.Chand publishing	First Edition, 2011
Web links and Video Lectures				
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math 				

POWER GENERATION AND ECONOMICS(Core Subject) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	17EE42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • Explain the arrangement and operation of hydroelectric, steam, diesel, gas turbine and nuclear power plants and working of major equipment in the plants. • Classification of substation and explain the operation of different substationequipment. • Explain the importance of grounding and different grounding methods used in practice. • Explain the economics of power generation and importance of power factor. 			
Module-1			Teaching Hours
Hydroelectric Power Plants: Hydrology, run off and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the plants based on water flow regulation, water head and type of load the plant has to supply. Water turbines – Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines Governing of turbines, selection of water turbines. Underground, small hydro and pumped storage plants. Choice of size and number of units, plant layout and auxiliaries. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Steam Power Plants: Introduction, Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries. Diesel Power Plant: Introduction, Merits and demerits, selection site, elements of diesel power plant, applications. Gas Turbine Power Plant: Introduction, Merits and demerits, selection site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple steam power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam and diesel power plants. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Nuclear Power Plants: Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Substations: Introduction to Substation equipment; Transformers, High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches, Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments, and power line carrier communication equipment. Classification of substations – indoor and outdoor, Selection of site for substation, Busbar arrangement schemes and single line diagrams of substations.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV				
17EE42 Power Generation and Economics (Core Subject) (continued)				Teaching Hours
Module-4 (continued)				
Substations (continued): Interconnection of power stations. Introduction to gas insulated substation, Advantages and economics of Gas insulated substation. Grounding: Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded, solid grounding, resistance grounding, reactance grounding, resonant grounding. Earthing transformer. Neutral grounding and neutral grounding transformer. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Economics: Introduction, Effect of variable load on power system, classification of costs, Cost analysis. Interest and Depreciation, Methods of determination of depreciation, Economics of Power generation, different terms considered for power plants and their significance, load sharing. Choice of size and number of generating plants. Tariffs, objective, factors affecting the tariff, types. Types of consumers and their tariff. Power factor, disadvantages, causes, methods of improving power factor, Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor. Choice of equipment. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants. • Classify various substations and explain the importance of grounding. • Understand the economic aspects of power system operation and its effects. • Explain the importance of power factor improvement. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Engineers and Society, Environment and Sustainability.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Books				
1	Power Plant Engineering	P.K. Nag	McGrawHill	4 th Edition, 2014
2	Generation of Electrical Energy	B.R.Gupta	S. Chand	2015
3	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
Reference Books				
4	A Course in Power Systems	J.B. Gupta	Katson	2008
5	Electrical Power Distribution Systems	V. Kamaraju	McGrawHill	1 st Edition, 2009
6	A Text Book on Power System Engineering	A.Chakrabarti, et al	DhanpathRai	2 nd Edition, 2010
7	Electrical Distribution Engineering	Anthony J. Pansini	CRC Press	3 rd Edition, 2006
8	Electrical Distribution Systems	Dale R Patrick Et al	CRC Press	2 nd Edition, 2009

TRANSMISSION AND DISTRIBUTION (Core Subject) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE43	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the concepts of various methods of generation of power. • To understand the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • To design insulators for a given voltage level. • To calculate the parameters of the transmission line for different configurations and assess the performance of the line. • To study underground cables for power transmission and evaluate different types of distribution systems. 			
Module-1			Teaching Hours
<p>Introduction to power system: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.</p> <p>Overhead transmission lines: A brief introduction to types of supporting structures and line conductors-Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All –aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI), Super thermal resistant aluminium alloy (ZTAI), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), Gap type super thermal resistant aluminium alloy conductor steel reinforced (GZTACSR). Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightning; ground wires.</p> <p>Overhead line Insulators: A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Line parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
<p>Performance of transmission lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal π circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
<p>Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.</p>			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
17EE43 TRANSMISSION AND DISTRIBUTION (Core Subject) (continued)				
Module-4 (continued)				Teaching Hours
Underground cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and dc cables. Limitations of cables. Specification of power cables. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated and uniform loads. Effect of disconnection of neutral in a 3 phase four wire system. Reliability and Quality of Distribution system: Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the concepts of various methods of generation of power. • Explain the importance of HVAC, EHVAC, UHVAC and HVDC transmission. • Design and analyze overhead transmission system for a given voltage level. • Calculate the parameters of the transmission line for different configurations and assess the performance offline. • Explain the use of underground cables and evaluate different types of distribution systems. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design / development of solutions, Engineers and society, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> <input type="checkbox"/> The question paper will have ten questions. <input type="checkbox"/> Each full question is for 16 marks. <input type="checkbox"/> There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. <input type="checkbox"/> Each full question with sub questions will cover the contents under a module. <input type="checkbox"/> Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Books:				
1	A Course in Electrical Power	Soni Gupta and Bhatnagar	Dhanpat Rai	-
2	Principles of Power System	V.K. Mehta, Rohit Mehta	S. Chand	1 st Edition 2013
Reference Books:				
3	Power System Analysis and Design	J. Duncan Glover et al	Cengage Learning	4 th Edition 2008
4	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009
5	Electrical Power	S.L. Uppal	Khanna Publication	
6	Electrical power systems	C. L. Wadhwa	New Age	5 th Edition, 2009
7	Electrical power systems	Ashfaq Hussain	CBS Publication	
8	Electric Power Distribution	A.S. Pabla	McGraw-Hill	6 th Edition, 2012
For High temperature conductors refer www.jpowers.co.jp/english/product/pdf/gap_c1.pdf and Power System Analysis and Design, J. Duncan Glover et al				

ELECTRIC MOTORS (Core Subject) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study the constructional features of Motors and select a suitable drive for specific application. • To study the constructional features of Three Phase and Single phase induction Motors. • To study different test to be conducted for the assessment of the performance characteristics of motors. • To study the speed control of motor by a different methods. • Explain the construction and operation of Synchronous motor and special motors. 			
Module-1			Teaching Hours
DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. Losses and efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Testing of dc motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests. Three phase Induction motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Performance of three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator; standalone operation and grid connected operation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods Single-phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Synchronous motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves.			10

Synchronous condenser, hunting and damping. Methods of starting synchronous motors.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
17EE44 ELECTRIC MOTORS (Core Subject) (continued)				
Module-5 (continued)				Teaching Hours
Other motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor and stepper motors.■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the constructional features of Motors and select a suitable drive for specific application. • Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method. • Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance. • Control the speed of induction motor by a suitable method. • Explain the operation of Synchronous motor and special motors. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern:				
<input type="checkbox"/> The question paper will have ten questions. <input type="checkbox"/> Each full question is for 16 marks. <input type="checkbox"/> There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. <input type="checkbox"/> Each full question with sub questions will cover the contents under a module. <input type="checkbox"/> Students will have to answer 5 full questions, selecting one full question from each module.■				
Text Books:				
1	Electric Machines	D. P. Kothari, I. J. Nagrath	McGraw Hill	4th edition, 2011
2	Theory of Alternating Current Machines	Alexander Langsdorf	McGraw Hill	2nd Edition, 2001
Reference Books:				
3	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
4	Electrical Machines	M.V. Deshpande	PHI Learning	2013
5	Electric Machinery and Transformers	Bhag S Guru et al	Oxford University Press	3 rd Edition, 2012
6	Electric Machinery and Transformers	Irving Kosow	Pearson	2nd Edition, 2012
7	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2nd Edition, 2013
8	Electric Machines	R.K. Srivastava	Cengage Learning	2nd Edition, 2013

ELECTROMAGNETIC FIELD THEORY (Core Subject) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE45	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course Objectives:			
<ul style="list-style-type: none"> • To study different coordinate systems for understanding the concept of gradient, divergence and curl of a vector. • To study the application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations. • To evaluate the energy and potential due to a system of charges. • To study the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • To study the magnetic fields and magnetic materials. • To study the time varying fields and propagation of waves in different media. 			
Module-1			Teaching Hours
Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Problems. Electrostatics: Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Problems. Conductor and Dielectrics: Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Capacitance of two wire line. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-3			
Poisson's and Laplace equations: Derivations and problems, Uniqueness theorem. Steady magnetic fields: Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-4			
Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Problems. Magnetic materials and magnetism: Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Problems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -IV				
17EE45 ELECTROMAGNETIC FIELD THEORY (Core Subject) (continued)				
Module-5				Teaching Hours
Time varying fields and Maxwell's equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Problems. Uniform plane wave: Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Problems. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course Outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Use different coordinate systems to explain the concept of gradient, divergence and curl of a vector. • Use Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations. • Calculate the energy and potential due to a system of charges. • Explain the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics. • Explain the behavior of magnetic fields and magnetic materials. • Assess time varying fields and propagation of waves in different media. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Books:				
1	Engineering Electromagnetics	William H Hayt et al	McGraw Hill	8 th Edition, 2014
2	Principles of Electromagnetics	Matthew N. O. Sadiku	Oxford	6 th Edition, 2015
Reference Books:				
3	Fundamentals of Engineering Electromagnetics	David K. Cheng	Pearson	2014
4	Electromagnetism -Theory (Volume -1) -Applications (Volume-2)	Ashutosh Pramanik	PHI Learning	2014
5	Electromagnetic Field Theory Fundamentals	Bhag Guru et al	Cambridge	2005
6	Electromagnetic Field Theory	Rohit Khurana	Vikas Publishing	1 st Edition, 2014
7	Electromagnetics	J. A. Edminister	McGraw Hill	3 rd Edition, 2010
8	Electromagnetic Field Theory and Transmission Lines	Gottapu Sasibhushana Rao	Wiley	1 st Edition, 2013

OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE46	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course Objectives:			
<ul style="list-style-type: none"> • To understand the basics of Linear ICs such as Op-amp, Regulator, Timer & PLL. • To learn the designing of various circuits using linear ICs. • To use these linear ICs for specific applications. • To understand the concept and various types of converters. • To use these ICs, in Hardware projects. 			
Module-1			Teaching Hours
Operational amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback(excluding derivations). General Linear Applications: A.C. amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, Instrumentation amplifier.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Active Filters: First & Second order high pass & low pass Butterworth filters. Band pass filters, all pass filters. DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Signal generators: Triangular / rectangular wave generator, phase shift oscillator, saw tooth oscillator. Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Signal processing circuits: Precision half wave & full wave rectifiers A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-5			
Phase Locked Loop (PLL): Basic PLL, components, performance factors. Timer: Internal architecture of 555 timer, Mono stable multivibrators and applications.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

ELECTRICAL AND ELECTRONIC MEASUREMENTS (Foundation Course) B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]				
17EE46 OPERATIONAL AMPLIFIERS AND LINEAR ICs (Foundation Course) (continued)				
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the characteristics of ideal and practical operational amplifier. • Design filters and signal generators using linear ICs. • Demonstrate the application of Linear ICs as comparators and rectifiers. • Use ICs in the electronic projects. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Design / development of solutions, Conduct investigations of complex Problems.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. 				
Text Books:				
1	Op-Amps and Linear Integrated Circuits	Ramakant A Gayakwad	Pearson	4 th Edition 2015
2	Operational Amplifiers and Linear ICs	David A. Bell	Oxford	3 rd Edition 2011
Reference Books:				
3	Linear Integrated Circuits; Analysis, Design and Applications	B. Somanthan Nair	Wiley India	2013
4	Linear Integrated Circuits	S. Salivahanan, et al	McGraw Hill	2 nd Edition, 2014
5	Operational Amplifiers and Linear Integrated Circuits	K. Lal Kishore	Pearson	1 st Edition, 2012

ELECTRICAL MACHINES LABORATORY - 2 B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL47	CIE Marks	40
Number of Practical Hours/Week	03=(1 hour instruction and 2 hour laboratory	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course Objectives:			
<ul style="list-style-type: none"> • To perform tests on dc machines to determine their characteristics. • To control the speed of dc motor. • To conduct test for pre-determination of the performance characteristics of dc machines • To conduct load test on single phase and three phase induction motor. • To conduct test on induction motor to determine the performance characteristics. • To conduct test on synchronous motor to draw the performance curves. ■ 			
Sl. No	Experiments		
1	Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.		
2	Field Test on dc series machines.		
3	Speed control of dc shunt motor by armature and field control.		
4	Swinburne's Test on dc motor.		
5	Retardation test on dc shunt motor.		
6	Regenerative test on dc shunt machines.		
7	Load test on three phase induction motor.		
8	No - load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).		
9	Load test on induction generator.		
10	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.		
11	Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.		
12	Conduct an experiment to draw curves of synchronous motor at no load and load conditions.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Test dc machines to determine their characteristics. • Control the speed of dc motor. • Pre-determine the performance characteristics of dc machines by conducting suitable tests. • Perform load test on single phase and three phase induction motor to assess its performance. • Conduct test on induction motor to pre-determine the performance characteristics. • Conduct test on synchronous motor to draw the performance curves. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.			

OP- AMP AND LINEAR ICS LABORATORY			
B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL48	CIE Marks	40
Number of Practical Hours/Week	03=(1 hour instruction and 2 hour laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course Objectives:			
<input type="checkbox"/> To conduct different experiments using OP-Amps <input type="checkbox"/> To conduct experiments using Linear IC's			
a) Study of pin details, specifications, application features of IC741 (LM741) and IC555 (Timer) through corresponding datasheets (Datasheets are instruction manuals for electronic components. They explain exactly what a component does and how to use it.). b) Comparison of output performance quantity of an Operational Amplifier obtained by rigging up the circuit with the ideal value of (i) A Non – Inverting Amplifier ($V_{out} = AV_{in}$) (ii) An Inverting Amplifier ($V_{out} = -AV_{in}$) (iii) A Difference Amplifier ($V_{out} = -A(V_p - V_n)$) (iv) A Difference Amplifier with floating inputs ($V_{out} = AV_{in}$) (v) A Non – Inverting Amplifier with negative feedback (ii) An Inverting Amplifier with negative feedback (vi) A Differential Amplifier with a negative feedback (vii) A Differential Amplifier with negative feedback and equalised amplifications. (viii) A Voltage follower (ix) A differential – in differential –out amplifier (x) An instrumentation amplifier c) Plot of input and output transfer characteristics to analyse and conclude that op-amps are rarely used in open-loop. d) Testing of op – amp.			To be covered in 03 Laboratory classes.
Sl. No	Experiments		
1	Design and verify a precision full wave rectifier. Determine the performance parameters.		
2	Design and realize to analyse the frequency response of an op – amp amplifier under inverting and non - inverting configuration for a given gain.		
3	Design and verify the output waveform of an op – amp RC phase shift oscillator for a desired frequency.		
4	Design and realize Schmitt trigger circuit using an op – amp for desired upper trip point (UTP) and lower trip point (LTP).		
5	Verify the operation of an op – amp as (a) voltage comparator circuit and (b) zero crossing detector.		
6	Design and verify the operation of op – amp as an (a) adder (b) subtractor (c) integrator and (d) differentiator.		
7	Design and realize an op – amp based first order Butterworth (a) low pass (b) high pass and (c) band pass filters for a given cut off frequency/frequencies to verify the frequency response characteristic.		
8	Design and realize an op – amp based function generator to generate sine, square and triangular waves of desired frequency.		
9	Design and realization of R-2R ladder DAC.		
10	Realization of Two bit Flash ADC		
11	Design and verify an IC 555 timer based pulse generator for the specified pulse.		
12	Designing of Fixed voltage power supply (voltage regulator) using IC regulators 78 series and 79 series.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course Outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • To conduct experiment to determine the characteristic parameters of OP-Amp • To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator 			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV
17EEL48 OP- AMP AND LINEAR ICS LABORATORY (continued)
Course Outcomes (continued): <ul style="list-style-type: none"> • To design test the OP-Amp as oscillators and filters • Design and study of Linear IC's as multivibrator power supplies.
Graduate Attributes (As per NBA) Engineering Knowledge, Individual and Team work, Communication.
Conduct of Practical Examination: <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

**** END ****

V SEMESTER DETAILED SYLLABUS

MANAGEMENT AND ENTREPRENEURSHIP (Core Course) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process. • To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff, the social responsibility of business and leadership. • To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship. • To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs • To discuss the importance of Small Scale Industries and the related terms and problems involved. • To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan. • To introduce the concepts of project management and discuss capital building process. • To explain project feasibility study and project appraisal and discuss project financing • To discuss about different institutions at state and central levels supporting business enterprises. ■ 			
Module-1			Teaching Hours
Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession. Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment. Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V	
17EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)	
Module-4	Teaching Hours
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions. ■</p>	10
<p>Revised Bloom’s Taxonomy Level</p>	L ₃ – Applying.
Module-5	
<p>Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.</p> <p>New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM. ■</p>	10
<p>Revised Bloom’s Taxonomy Level</p>	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Explain the field of management, task of the manager, planning and the need of proper staff, recruitment and selection process. • Discuss work allocation, the structure of organization, the modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff in exercising the authority and delegating duties. • To explain the social responsibility of business and leadership • Explain the concepts of entrepreneurship and the role and importance of the entrepreneur in economic development. • Show an understanding of the role and importance of Small Scale Industries, business plan and its presentation. • Discuss the concepts of project management, capital building process, project feasibility study, project appraisal and project financing. • Discuss the state /central level institutions / agencies supporting business enterprises. ■ 	
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
17EE51 MANAGEMENT AND ENTREPRENEURSHIP (Core Course) (continued)				
Textbooks				
1	Principles of Management	P.C.Tripathi, P.N.Reddy	McGraw Hill,	6 th Edition, 2017
2	Entrepreneurship Development And Small Business Enterprises	Poornima M.Charanthimath	Pearson	2 nd Edition,2014
Reference Books				
1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership perspective	Harold Koontz, Heinz Weihrich	McGraw Hill	10 th Edition 2016

MICROCONTROLLER (Core Course) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE52	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> <input type="checkbox"/> To explain the internal organization and working of Computers, microcontrollers and embedded processors. <input type="checkbox"/> Compare and contrast the various members of the 8051 family. <input type="checkbox"/> To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions. <input type="checkbox"/> To explain in detail the execution of 8051 Assembly language instructions and datatypes <input type="checkbox"/> To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions. <input type="checkbox"/> To explain different addressing modes of 8051, arithmetic, logic instructions, and programs. <input type="checkbox"/> To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic, arithmetic operations and data conversion. ■ 			
Module-1			Teaching Hours
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
8051 programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C 8051 Timer programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
8051 serial port programming in assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. 8051 Interrupt programming in assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
17EE52 MICROCONTROLLER (Core Course) (continued)				
Module-5				Teaching Hours
Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and sensor interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. Motor control: Relay, PWM, DC and stepper motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM. 8051 interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255.				10
Revised Bloom's Taxonomy Level		L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. ■		
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss the history of the 8051 and features of other 8051 family members and the internal architecture of the 8051. • Explains the use of an 8051 assembler, the stack and the flag register, loop, jump, and call instructions. • Discuss 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs. • Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization • Discuss the hardware connection of the 8051 chip, its timers, serial data communication and its interfacing of 8051 to the RS232. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2 nd Edition, 2008.
Reference Books				
1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3 rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1 st Edition, 2012

POWER ELECTRONICS (Core Course) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE53	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics. • To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits. • To explain the techniques for design and analysis of single phase diode rectifier circuits. • To explain different power transistors, their steady state and switching characteristics and limitations. • To explain different types of Thyristors, their gate characteristics and gate control requirements. • To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■ 			
Module-1			Teaching Hours
Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches. Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Diode Switched <i>RL</i> Load, Freewheeling Diodes with Switched <i>RL</i> Load. Diode Rectifiers: Introduction, Single-Phase Full-Wave Rectifiers, Single-Phase Full-Wave Rectifier with <i>RL</i> Load, Single-Phase Full-Wave Rectifier with a Highly Inductive Load. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-2			
Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-3			
Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, <i>di/dt</i> Protection, <i>dv/dt</i> Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing		
Module-4			
Controlled Rectifiers: Introduction, Single-Phase Full Converters, Single-Phase Dual Converters, Three-Phase Full Converters, Three-Phase Dual Converters, AC Voltage Controllers: Introduction, Single-Phase Full-Wave Controllers with Resistive Loads, Single-Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V				
17EE53 POWER ELECTRONICS (Core Course) (continued)				
Module-5				Teaching Hours
DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification. DC-AC converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain application area of power electronics, types of power electronic circuits and switches their characteristics and specifications. • Explain types of power diodes, their characteristics, and the effects of power diodes on RL circuits. • Explain the techniques for design, operation and analysis of single phase diode rectifier circuits. • Explain steady state, switching characteristics and gate control requirements of different power transistors and their limitations. • Discuss different types of Thyristors, their operation, gate characteristics and gate control requirements. • Explain designing, analysis techniques and characteristics of thyristor controlled rectifiers. • Discuss the principle of operation of single phase and three phase DC - DC, DC –AC converters and AC voltage controllers. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014
Reference Books				
1	Power Electronics: Converters, Applications and Design	Ned Mohan et al	Wiley	3rd Edition, 2014
2	Power Electronics	Daniel W Hart	McGraw Hill	1 st Edition, 2011
3	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

SIGNALS AND SYSTEMS (Core Course) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			
Course objectives:			
<ul style="list-style-type: none"> <input type="checkbox"/> To discuss arising of signals in different systems. <input type="checkbox"/> To classify the signals and define certain elementary signals. <input type="checkbox"/> To explain basic operations on signals and properties of systems. <input type="checkbox"/> To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains. <input type="checkbox"/> To explain the properties of linear time invariant systems in terms of impulse response description. <input type="checkbox"/> To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it. <input type="checkbox"/> To explain Fourier transform representation of continuous time and discrete time non –periodic signals and the properties of Fourier Transforms. <input type="checkbox"/> To explain the applications of Fourier transform representation to study signals and linear time invariant systems. <input type="checkbox"/> To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■ 			
Module-1			Teaching Hours
Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L – 4 Analysing, L ₅ – Evaluating.		
Module-2			
Time – Domain Representations For LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-3			
The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of differential equations.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating..		
Module-5			
Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – V**

17EE54 SIGNALS AND SYSTEMS (Core Subject) (continued)

Course outcomes:

At the end of the course the student will be able to:

- Classify the signals and systems.
- Explain basic operations on signals and properties of systems.
- Use convolution in both continuous and discrete domain for the analysis of systems given the impulse response of a system.
- Evaluate response of a given linear time invariant system.
- Provide block diagram representation of a linear time invariant system.
- Apply continuous time Fourier transform representation to study signals and linear time invariant systems.
- Apply discrete time Fourier transform representation to study signals and linear time invariant systems. Use Z-transform and properties of Z transform for the analysis of discrete time systems. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2 nd Edition, 2002
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Reference Books

2	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2 nd Edition 2010
3	Signals and Systems	NagoorKani	McGraw Hill	1 st Edition 2010
4	Signals and Systems A Primer with MATLAB	Matthew N.O. Sadiku Warsame H. Ali	CRC Press	1 st Edition, 2016
5	Signals and Systems	Anand Kumar	PHI	3 rd Edition, 2015

ELECTRICAL ENGINEERING MATERIALS (Professional Elective) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE552	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits – 03			
Course objectives:			
<ul style="list-style-type: none"> • To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications. ■ • To impart the knowledge of superconducting materials and their applications 			
Module-1			Teaching Hours
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.			08
Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems . ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Conductive Materials and Applications: Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.			08
Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behaviour of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant.			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.			08
Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Magnetic Materials (continued): Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.			08
Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – V 17EE552 ELECTRICAL ENGINEERING MATERIALS (Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Superconductive Materials (continued): and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London’s theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics. ■				
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				08
Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic. Materials for Opto – Electronic Devices: Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell. ■				
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electrical and electronics materials, their importance, classification and operational requirement • Discuss conducting materials used in engineering, their properties and classification. • Discuss dielectric materials used in engineering, their properties and classification. • Discuss insulating materials used in engineering, their properties and classification. • Discuss magnetic materials used in engineering, their properties and classification • Explain the phenomenon superconductivity, super conducting materials and their application in engineering. • Explain the plastic and its properties and applications. • Discuss materials used for Opto electronic devices. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Advanced Electrical and Electronics Materials; Processes and Applications	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015
Reference Books				

PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE562	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC. • To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map. • To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction. • To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs. • To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays. • To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions. • To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems. • To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction. • To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions. • To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations. • To describe the operation of bit and word shift registers and develop programs that use shift registers. • To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. 			
Module-1			Teaching Hours
Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application. PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs). Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding,		
Module-2			

<p>Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.</p> <p>Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.</p>	08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding..

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V		
17EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)		
Module-3	Teaching Hours	
Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions. Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.	08	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding..	
Module-4		
Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control. Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■	08	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.	
Module-5		
Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations. Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■	08	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.	
Course outcomes:		
At the end of the course the student will be able to:		
<ul style="list-style-type: none"> • Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions. • Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming. • Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module. • Convert relay schematics and narrative descriptions into PLC ladder logic programs • Analyze PLC timer and counter ladder logic programs • Describe the operation of different program control instructions • Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system. • Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. 		
Graduate Attributes (As per NBA)		
Engineering Knowledge		
Question paper pattern:		
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. 		
Students will have to answer 5 full questions, selecting one full question from each module.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
17EE562 PROGRAMMABLE LOGIC CONTROLLERS (Open Elective) (continued)				
Textbook				
1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill,	4 th Edition, 2011
Reference Book				
1	Programmable Logic Controllers an Engineer's Guide,	E A Parr	Newnes	3 rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3 rd Edition, 2006

RENEWABLE ENERGY RESOURCES(Open Elective) B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE563	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. • To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships • To discuss about solar energy reaching the Earth’s surface and solar thermal energy applications. • To discuss types of solar collectors, their configurations and their applications • To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications. • To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages. • To discuss wind turbines, wind resources, site selection for wind turbine • To discuss geothermal systems, their classification and geothermal based electric power generation • To discuss waste recovery management systems, advantages and disadvantages • To discuss biomass production, types of biomass gasifiers, properties of producer gas. • To discuss biogas, its composition, production, benefits. • To discuss tidal energy resources, energy availability, power generation. • To explain motion in the sea wave, power associated with sea wave and energy availability and the devices for harnessing wave energy. • To discuss principles of ocean thermal energy conversion and production of electricity. 			
Module-1			Teaching Hours
<p>Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.</p> <p>Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth’s Surface, Solar Thermal Energy Applications.</p> <p>■</p>			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
<p>Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond.</p> <p>Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic Panels, Applications of Solar Cell Systems. ■</p>			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			

<p>Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.</p> <p>Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.</p> <p>Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects.</p>	08
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B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V	
17EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)	
Module-3 (continued)	Teaching Hours
<p>Solid waste and Agricultural Refuse: Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■</p>	
<p>Revised Bloom's Taxonomy Level L₁ – Remembering, L₂ – Understanding, L₃ – Applying, L₄ – Analysing.</p>	
Module-4	
<p>Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.</p> <p>Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.</p> <p>Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy.</p>	08
<p>Revised Bloom's Taxonomy Level L₁ – Remembering, L₂ – Understanding, L₃ – Applying, L₄ – Analysing.</p>	
Module-5	
<p>Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.</p> <p>Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■</p>	08
<p>Revised Bloom's Taxonomy Level L₁ – Remembering, L₂ – Understanding, L₃ – Applying.</p>	
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss causes of energyscarcity and its solution, energy resources and availability of renewable energy. • Discuss energy from sun, energy reaching the Earth's surface and solar thermal energy applications. • Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications. • Discus generation of energy from hydrogen, wind, geothermal system, solid waste and agriculturerefuse. • Discuss production of energy from biomass, biogas. • Discuss tidal energy resources, energy availability and power generation. 	

<ul style="list-style-type: none"> Discuss power generation sea wave energy and ocean thermal energy.
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.
Question paper pattern: <ul style="list-style-type: none"> The question paper will have ten questions. Each full question is for 16 marks. There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. Each full question with sub questions will cover the contents under a module.

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - V				
17EE563 RENEWABLE ENERGY RESOURCES(Open Elective) (continued)				
Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1 st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3 rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3 rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1 st Edition, 2011

MICROCONTROLLER LABORATORY - 1			
B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL57	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
■ Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions. • To explain writing assembly language programs for code conversions. • To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers. ■ • To perform interfacing of stepper motor and dc motor for controlling the speed. • To explain generation of different waveforms using DACinterface. 			
Sl. NO	Experiments		
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.			
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.		
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for 16 bit numbers.		
3	Counters		
4	Boolean and logical instructions (bit manipulation).		
5	Conditional call and return instructions.		
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa decimal to and Decimal to Hexa. ■		
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.		
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.			
8	Stepper motor interface.		
9	DC motor interface for direction and speed control using PWM.		
10	Alphanumerical LCD panel interface.		
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.		
12	External ADC and Temperature control interface.		
13	Elevator interface. ■		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		

Course outcomes:

At the end of the course the student will be able to:

- Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
- Write ALP for code conversions.
- Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- Perform interfacing of stepper motor and dc motor for controlling the speed.

- Generate different waveforms using DAC interface.
- Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work.

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -V**

17EEL57 MICROCONTROLLER LABORATORY – 1(continued)

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Learning beyond the syllabus: To acquire a wide variety of skills and to develop society friendly applications mini projects can be practiced by referring to “Microcontroller Based Projects” Second Edition, An EFY (Electronics For You) Enterprise Pvt Ltd, 2013.

POWER ELECTRONICS LABORATORY B.E., V Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL58	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments on semiconductor devices to obtain their static characteristics. • To study different methods of triggering the SCR • To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • To control the speed of a dc motor, universal motor and stepper motors. • To study single phase full bridge inverter connected to resistive load. • To study commutation of SCR. ■ 			
Sl. No	Experiments		
1	Static Characteristics of SCR.		
2	Static Characteristics of MOSFET and IGBT.		
3	Characteristic of TRIAC.		
4	SCR turn on circuit using synchronized UJT relaxation oscillator.		
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.		
6	Single phase controlled full wave rectifier with R and R –L loads.		
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.		
8	Speed control of dc motor using single semi converter.		
9	Speed control of stepper motor.		
10	Speed control of universal motor using ac voltage regulator.		
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.		
12	Design of Snubber circuit.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Obtain static characteristics of semiconductor devices to discuss their performance. • Trigger the SCR by different methods • Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. • Control the speed of a dc motor, universal motor and stepper motors. • Verify the performance of single phase full bridge inverter connected to resistive load. • Perform commutation of SCR by different methods. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

VI SEMESTER DETAILED SYLLABUS

CONTROL SYSTEMS (Core Subject) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE61	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
To define a control system			
To explain the necessity of feedback and types of feedback control systems.			
To introduce the concept of transfer function and its application to the modeling of linear systems.			
To demonstrate mathematical modeling of control systems.			
To obtain transfer function of systems through block diagram manipulation and reduction			
To use Mason's gain formula for finding transfer function of a system			
To discuss transient and steady state time response of a simple control system.			
To discuss the stability of linear time invariant systems and Routh - Hurwitz criterion			
To investigate the trajectories of the roots of the characteristic equation when a system parameter is varied.			
To conduct the control system analysis in the frequency domain.			
To analyze stability of a control system using Nyquist plot.			
To discuss stability analysis using Bodeplots.			
To determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications.			
Module-1			Teaching Hours
Introduction to control systems: Introduction, classification of control systems. Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Block diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function. Signal flow graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants, types of control systems. Routh Stability criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis.			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Root locus technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus. Frequency Response analysis: Co-relation between time and frequency response – 2 nd order systems only. Bode plots: Basic factors $G(i\omega)/H(j\omega)$, General procedure for constructing bode plots, computation of gain margin and phase margin.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
17EE61 CONTROL SYSTEMS (Core Subject) (continued)				
Module-5				Teaching Hours
Nyquist plot: Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion. Design of Control Systems: Introduction, Design with the PD Controller, Design with the PI Controller, Design with the PID Controller, Design with Phase-Lead Controller, Design with Phase-Lag Controller, Design with Lead-Lag Controller.				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss the effects of feedback and types of feedback control systems. • Evaluate the transfer function of a linear time invariant system. • Evaluate the stability of linear time invariant systems. • Apply block diagram manipulation and signal flow graph methods to obtain transfer function of systems. • Demonstrate the knowledge of mathematical modeling of control systems and components • Determine transient and steady state time response of a simple control system. • Investigate the performance of a given system in time and frequency domains. • Discuss stability analysis using Root locus, Bode plots and Nyquist plots. • Determine the controller or compensator configuration and parameter values relative to how it is connected to the controlled process given the design specifications. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Modern Tool Usage, Life-long Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	Control Systems	Anand Kumar	PHI	2 nd Edition, 2014
Reference Books				
1	Automatic Control Systems	Farid Golnaraghi, Benjamin C. Kuo	Wiley	9 th Edition, 2010
2	Control Systems Engineering	Norman S. Nise	Wiley	4 th Edition, 2004
3	Modern Control Systems	Richard C Dorf et al	Pearson	11 th Edition, 2008
4	Control Systems, Principles and Design	M.Gopal	McGaw Hill	4 th Edition, 2012
5	Control Systems Engineering	S. Salivahanan et al	Pearson	1 st Edition, 2015

POWER SYSTEM ANALYSIS – 1 (Core Subject) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE62	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce the per unit system and explain its advantages and computation. • To explain the concept of one line diagram and its implementation in problems. • To explain the necessity and conduction of short circuit analysis. • To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems. • To discuss selection of circuit breaker. • To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits. • To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits. • To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines. • To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. • To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine • Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system. 			
Module-1			Teaching Hours
Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of electrical Power, Representation of Loads.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine (On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System, Measurement of sequence Impedance of Synchronous Generator.			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults.■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
17EE62 POWER SYSTEM ANALYSIS – 1 (Core Subject) (continued)				
Module-5				Teaching Hours
Power System Stability: Introduction, Dynamics of a Synchronous Machine, Power Angle Equation Salient and Non – Salient pole Synchronous Machines, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability.■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Show understanding of per unit system, its advantages and computation. • Show the concept of one line diagram and its implementation in problems • Perform short circuit analysis on a synchronous machine and simple power system to select a circuit breaker for the system. • Evaluate symmetrical components of voltages and currents in un-balanced three phase circuits. • Explain the concept of sequence impedance and sequence networks of power system components and power system. • Analyze three phase synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components. 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, The Engineer and Society, Ethics				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1.	Modern Power System	D. P. Kothari	McGraw Hill	4 th Edition, 2011
Reference Books				
1	Elements of Power System	William D. Stevenson Jr	McGraw Hill	4 th Edition, 1982
2	Power System Analysis and Design	J.Duncan Glover et al	Cengage	4 th Edition, 2008
3	Power System Analysis	Hadi Sadat	McGraw Hill	1 st Edition, 2002

DIGITAL SIGNAL PROCESSING (Core Subject) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE63	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define Discrete Fourier transform and its properties. • To evaluate DFT of various signals using properties of DFT. • To explain different linear filtering techniques. • To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms • To discuss impulse invariant transformation, bilinear transformation techniques and their properties. • To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques. • To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques. • To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter. • To discuss window functions used for the design of FIR filters. • To discuss windowing technique of designing FIR filter. • To discuss frequency sampling technique of designing FIR filter. • To discuss direct, cascade and linear phase form of realizing a digital FIR filter. 			
Module-1			Teaching Hours
Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham’s method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-2			
Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms.			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-3			
Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations.			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing. L ₅ – Evaluating		
Module-4			
Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type I filter by impulse invariant transformation and bilinear transformation, Frequency transformations. Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial.			10

Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating		
B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI			
17EE63 DIGITAL SIGNAL PROCESSING (Core Subject) (continued)			
Module-5	Teaching Hours		
Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, design of FIR digital filters by use of windows, Design of FIR digital filters-frequency sampling techniques. Realization of FIR systems: direct form, cascade form, linear phase form			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating		
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Compute the DFT of various signals using its properties and linear filtering of two sequences. • Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence • Design infinite impulse response Butterworth digital filters using impulse invariant / bilinear transformation technique. • Design infinite impulse response Chebyshev digital filters using impulse invariant or bilinear transformation technique. • Realize a digital IIR filter by direct, cascade, parallel and ladder methods of realization. • Discuss different window functions and frequency sampling method used for design of FIR filters. • Design FIR filters by use of window function or by frequency sampling method. • Realize a digital FIR filter by direct, cascade, and linear phase form. 			
Graduate Attributes (As per NBA) Engineering Knowledge, Problem analysis, Design/ Development of Solutions, Modern Tool Usage.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			
Textbook			
1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson 1 st Edition, 2016
Reference Books			
1.	Digital Signal Processing – Principles, Algorithms, and Applications	Jhon G. Proakis Dimitris G. Manolakis	Pearson 4 th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill 2 nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley 2 nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage 1 st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford 1 st Edition, 2015

ELECTRICAL MACHINE DESIGN (Core Course) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE64	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> □ To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines. To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines. To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines. To discuss the selection of specific loadings, for various machines. To discuss separation of main dimensions for different electrical machines To discuss design of field windings for DC machines and synchronous machines. To evaluate the performance parameters of transformer, induction motor. To design of cooling tubes for the transformer for a given temperature rise. To explain design of rotor of squirrel cage rotor and slip ring rotor. To define short circuit ratio and discuss its effect on machine performance. 			
Module-1			Teaching Hours
Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.			10
Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration.			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance.			10

Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI				
17EE64 ELECTRICAL MACHINE DESIGN (Core Course) (continued)				
Module-5				
Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding. ■				10
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing. L ₂ – Understanding, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss design factors, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines. • Derive the output equations of transformer, DC machines and AC machines. • Discuss selection of specific loadings and magnetic circuits of different electrical machines • Design the field windings of DC machine and Synchronous machine. • Design stator and rotor circuits of a DC and AC machines. • Estimate the number of cooling tubes, no load current and leakage reactance of core type transformer. • Discuss short circuit ratio and its effects on performance of synchronous machines. • Design salient pole and non-salient pole alternators for given specifications. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	A course in Electrical Machine design	A.K.Sawhney	DhanpatRai	6 th Edition, 2013
Reference Books				
1	Performance and Design of Alternating Current Machines	M.G. Say	CBS Publisher	3 rd Edition, 2002
2	Design Data Handbook	A. Sanmugasundaram Et al	New Age International	1 st Edition, 2011

COMPUTER AIDED ELECTRICAL DRAWING (PROFESSIONAL ELECTIVE) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE651	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss the terminology of DC and AC armature windings. • To discuss design and procedure to draw armature winding diagrams for DC and AC machines. • To discuss the substation equipment, their location in a substation and development of a layout for substation. • To discuss different sectional views of transformers, DC machine, its parts and alternator and its parts. • To explain development of sectional views of Transformers, DC machine and alternators using the design data, sketches. 			
Suitable CAD software can be used for drawings			
PART - A			
Module-1			Teaching Hours
Winding Diagrams: (a) Developed Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings. (b) Developed Winding Diagrams of A.C. Machines: (c) Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings. (d) Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Single Line Diagrams: Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power-Line Carrier) and Line Trap.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
PART - B			
Module-3			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:			08

D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately.		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	
Module-5		
Electrical Machine Assembly Drawings Using Design Data, Sketches or Both: Alternator – Sectional Views of Stator and Rotor dealt separately. ■		08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VI				
17EE651 COMPUTER AIDED ELECTRICAL DRAWING (Professional Elective) (continued)				
Course Outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss the terminology and types of DC and AC armature windings. • Develop armature winding diagram for DC and AC machines • Develop a layout for substation using the standard symbols for substation equipment. . • Draw sectional views of core and shell types transformers using the design data • Draw sectional views of assembled DC machine or its parts using the design data or the sketches. • Draw sectional views of assembled alternator or its parts using the design data or the sketches. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Modern tool usage, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have two parts, PART – A and PART – B. • Each part is for 40 marks. • Part A is for Modules 1 and 2. • Questions 1 and 2 of PART - A will be only on DC windings or only on AC windings. Students have to answer any one of them. The marks prescribed is 25. • Question 3 of PART – A covering module 2 is compulsory. The marks prescribed is 15. • Part B is for Modules 3, 4 and 5. • Questions 4 and 5 will cover any two modules of modules 3, 4 and 5. Students have to answer any one of them. The marks prescribed is 40. ■ 				
Reference Books				
1	A course in Electrical Machine design	A. K. Sawhney	Dhanpat Rai	6 th Edition, 2013
2	Electrical Engineering Drawing	K. L. Narang	Satya Prakashan	2014

SENSORS AND TRANSDUCERS(Open Elective) B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE662	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits – 03			
Course objectives:			
To discuss need of transducers, their classification, advantages and disadvantages.			
To discuss working of different types of transducers and sensors..			
To discuss recent trends in sensor technology and their selection.			
To discuss basics of signal conditioning and signal conditioning equipment.			
To discuss configuration of Data Acquisition System and data conversion.			
To discuss the basics of Data transmission and telemetry.			
To explain measurement of various non-electrical quantities.			
Module-1			Teaching Hours
Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers. Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Data Transmission and Telemetry: Data/Signal Transmission, Telemetry. Measurement of Non – Electrical Quantities: Pressure Measurement			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER – VI				
17EE662 SENSORS AND TRANSDUCERS(Open Elective) (continued)				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss need of transducers, their classification, advantages and disadvantages. • Show an understanding of working of various transducers and sensors. • Discuss recent trends in sensor technology and their selection. • Discuss basics of signal conditioning and signal conditioning equipment. • Discuss configuration of Data Acquisition System and data conversion. • Show knowledge of data transmission and telemetry. • Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. 				
Graduate Attributes (As per NBA) Engineering Knowledge				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. 				
Textbook				
1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3 rd Edition, 2013.
Reference Books				
1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13 th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VI
17EEL67 CONTROL SYSTEM LABORATORY(continued)
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Use software package or discrete components in assessing the time and frequency domain responses of a given second order system. • Design and analyze Lead, Lag and Lead – Lag compensators for given specifications. • Determine the performance characteristics of ac and dc servomotors and synchro-transmitter receiver pair used in control systems. • Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system. • Write a script files to plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package. • Work with a small team to carryout experiments and prepare reports that present lab work.
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Individual and Team work, Modern tool usage, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions list prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

DIGITAL SIGNAL PROCESSING LABORATORY B.E., VI Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL68	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To explain the use of MATLAB/Scilab/Python software in evaluating the DFT and IDFT of given sequence • To verify the convolution property of the DFT • To design and implementation of IIR and FIR filters for given frequency specifications. • To realize IIR and FIR filters. ■ • To help the students in developing software skills. 			
Sl. No	Experiments		
1	Verification of Sampling Theorem both in time and frequency domains		
2	Evaluation of impulse response of a system		
3	To perform linear convolution of given sequences		
4	To perform circular convolution of given sequences using (a) the convolution summation formula (b) the matrix method and (c) Linear convolution from circular convolution with zero padding.		
5	Computation of N – point DFT and to plot the magnitude and phase spectrum.		
6	Linear and circular convolution by DFT and IDFT method.		
7	Solution of a given difference equation.		
8	Calculation of DFT and IDFT by FFT		
9	Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters)		
10	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions		
11	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique.		
12	Realization of IIR and FIR filters		
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating,		
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Give physical interpretation of sampling theorem in time and frequency domains. • Evaluate the impulse response of a system. • Perform convolution of given sequences to evaluate the response of a system. • Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods. • Provide a solution for a given difference equation. • Design and implement IIR and FIR filters • Conduct experiments using software and prepare reports that present lab work ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Conduct of Practical Examination:			
1. All laboratory experiments are to be included for practical examination.			
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.			
3. Students can pick one experiment from the questions lot prepared by the examiners.			
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■			

**** END ****

VII SEMESTER DETAILED SYLLABUS

POWER SYSTEM ANALYSIS – 2(Core Course) B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE71	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> ● To explain formulation of network models and bus admittance matrix for solving load flow problems. ● To discuss solution of nonlinear static load flow equations by different numerical techniques and methods to control voltage profile. ● To discuss optimal operation of generators on a bus bar, optimal unit commitment, reliability considerations and optimum generation scheduling. ● To discuss optimal power flow solution, scheduling of hydro-thermal system, power system security and reliability. ● To explain formulation of bus impedance matrix for the use in short circuit studies on power systems. ● To explain numerical solution of swing equation for multi-machine stability 			
Module-1			Teaching Hours
Load Flow Studies: Introduction, Network Model Formulation, Formation of by Singular Transformation, Load Flow Problem, Gauss-Seidel Method.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-2			
Load Flow Studies (continued): Newton-Raphson Method, Decoupled Load Flow Methods, Comparison of Load Flow Methods, Control of Voltage Profile.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-3			
Optimal System Operation: Introduction, Optimal Operation of Generators on a Bus Bar, Optimal Unit Commitment, Reliability Considerations, Optimum Generation Scheduling.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-4			
Optimal System Operation (continued): Optimal Load Flow Solution, Optimal Scheduling of Hydrothermal System, Power System Security, Maintenance Scheduling, Power System Reliability. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Module-5			
Symmetrical Fault Analysis: Algorithm for Short Circuit Studies, Formulation. Power System Stability: Numerical Solution of Swing Equation, Multimachine Stability.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying L ₄ – Analysing.		
Course outcomes:			
At the end of the course the student will be able to:			
Formulate network matrices and models for solving load flow problems.			
Perform steady state power flow analysis of power systems using numerical iterative techniques.			

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) 17EE71POWER SYSTEM ANALYSIS – 2(Core Subject) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Course outcomes(continued):				
<ul style="list-style-type: none"> • Discuss optimal scheduling for hydro-thermal system, power system security and reliability. • Analyze short circuit faults in power system networks using bus impedance matrix. • Perform numerical solution of swing equation for multi-machine stability. 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	Modern Power System Analysis	D. P. Kothari	McGraw Hill	4 th Edition, 2011
Reference Books				
1	Computer Methods in Power Systems Analysis	Glenn W Stagg Ahmed H Ei - Abiad	McGraw Hill	1stEdition, 1968
2	Computer Techniques in Power System Analysis	M.A. Pai	McGraw Hill	2ndEdition, 2006
3	Power System Analysis	HadiSaadat	McGraw Hill	2ndEdition, 2002

POWER SYSTEM PROTECTION(Core Subject) B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE72	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
To discuss performance of protective relays, components of protection scheme and relay terminology.			
To explain relay construction and operating principles.			
To explain Overcurrent protection using electromagnetic and static relays and Overcurrent protective schemes.			
To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays.			
To discuss pilot protection; wire pilot relaying and carrier pilot relaying.			
To discuss construction, operating principles and performance of various differential relays for differential protection.			
To discuss protection of generators, motors, Transformer and Bus Zone Protection.			
To explain the principle of circuit interruption and different types of circuit breakers.			
To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.			
To discuss protection Against Overvoltages and Gas Insulated Substation (GIS).			
Module-1			Teaching Hours
Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.			10
Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.			
Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting.			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Overcurrent Protection (continued): Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.			10
Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges (Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■			
Revised Bloom's Taxonomy Level			
	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			

Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection. Rotating Machines Protection: Introduction, Protection of Generators. Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection.		10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.	
B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII		
17EE72 POWER SYSTEM PROTECTION (Core Course) (continued)		
Module-4		Teaching Hours
Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF ₆ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers.		10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	
Module-5		
Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination. Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL). Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS).		10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss performance of protective relays, components of protection scheme and relay terminology overcurrent protection. • Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays. • Discuss pilot protection; wire pilot relaying and carrier pilot relaying. • Discuss construction, operating principles and performance of differential relays for differential protection. • Discuss protection of generators, motors, Transformer and Bus Zone Protection. 		
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Ethics, Communication, Life-long Learning.		

Question paper pattern:

- The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

Textbook

1	Power System Protection and Switchgear	Badri Ram, D.N. Vishwakarma	McGraw Hill	2 nd Edition
2	Power System Protection and Switchgear (For additional study on gapless arrester, Refer to pages 458 to 461)	Bhuvanesh Oza et al	McGraw Hill	1 st Edition, 2010

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - VII**

17EE72 POWER SYSTEM PROTECTION (Core Course) (continued)

Reference Books

1	Protection and Switchgear	Bhavesht et al	Oxford	1 st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1 st Edition, 2009
3	Fundamentals of Power System Protection	Y.G. Paithankar S.R. Bhide	PHI	1 st Edition, 2009

HIGH VOLTAGE ENGINEERING (Core Course) B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE73	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
To discuss conduction and breakdown in gases, liquid dielectrics.			
To discuss breakdown in solid dielectrics.			
To discuss generation of high voltages and currents and their measurement.			
To discuss overvoltage phenomenon and insulation coordination in electric power systems.			
Module-1			Teaching Hours
Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ , Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.			10
Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.			
Breakdown in Solid Dielectrics: Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-3			
Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering , L ₂ – Understanding L ₃ – Applying.		
Module-4			
Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.			10

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
17EE73 HIGH VOLTAGE ENGINEERING (Core Course) (continued)				
Module-5 (continued)				Teaching Hours
High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain conduction and breakdown phenomenon in gases, liquid dielectrics. • Explain breakdown phenomenon in solid dielectrics. • Explain generation of high voltages and currents • Discuss measurement techniques for high voltages and currents. • Discuss overvoltage phenomenon and insulation coordination in electric power systems. • Discuss non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	High Voltage Engineering	M.S. Naidu, V.Kamaraju	McGraw Hill	5 th Edition, 2013.
Reference Books				
1	High Voltage Engineering Fundamentals	E. Kuffel, W.S. Zaengl, J. Kuffel	Newnes	2 nd Edition, 2000
2	High Voltage Engineering	Wadhwa C.L.	New Age International	3 rd Edition, 2012
3	High-Voltage Test and Measuring Techniques	Wolfgang Hauschild • Eberhard Lemke	Springer	1 st Edition 2014
4	High Voltage Engineering	Farouk A.M. Rizk	CRC Press	1 st Edition 2014

UTILIZATION OF ELECTRICAL POWER(Professional Elective) B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE742	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To discuss electric heating, air-conditioning and electricwelding. • To explain laws of electrolysis, extraction and refining of metals and electrodeposition. • To explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting • To discuss systems of electric traction, speed time curves and mechanics of train movement. • To discuss motors used for electric traction and their control. • To discuss braking of electric motors, traction systems and power supply and other traction systems. • Give awareness of technology of electric and hybrid electricvehicles. ■ ■ 			
Module-1			Teaching Hours
Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques. Electrolytic Electro – Metallurgical Process: Ionization, Faraday’s Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, ElectroDeposition.			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting.			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion. Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor. Control of motors: Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■			08
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes. Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification, Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC			08

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B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
17EE742 UTILIZATION OF ELECTRICAL POWER(Professional Elective) (continued)				
Module-4 (continued)				Teaching Hours
Traction, Feeding and Distribution System for Dc Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires. Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption. Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss electric heating, air-conditioning and electric welding. • Explain laws of electrolysis, extraction and refining of metals and electro deposition. • Explain the terminology of illumination, laws of illumination, construction and working of electric lamps. • Design interior and exterior lighting systems- illumination levels for factory lighting- flood lighting- street lighting. • Discuss systems of electric traction, speed time curves and mechanics of train movement. • Explain the motors used for electric traction and their control. • Discuss braking of electric motors, traction systems and power supply and other traction systems. • Explain the working of electric and hybrid electric vehicles. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, The Engineer and Society, Ethics, Individual and Team Work.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	A Textbook on Power System Engineering	A. Chakrabarti et al	Dhanpat Rai and Co	2 nd Edition, 2010
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5)	Mehrddad Ehsani et al	CRC Press	1 st Edition, 2005
Reference Books				
1	Utilization, Generation and Conservation of Electrical Energy	Sunil S Rao	Khanna Publishers	1 st Edition, 2011
2	Utilization of Electric Power and Electric Traction	G.C. Garg	Khanna Publishers	9 th Edition, 2014

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VII				
17EE752 TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Professional Elective) (continued)				
Module-5				Teaching Hours
<p>Switchgear and Protective Devices: Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.</p> <p>Domestic Installation: Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation</p>				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ –Analysing, L ₅ –Evaluating.			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Describe the process to plan, control and implement commissioning of electrical equipment's. • Differentiate the performance specifications of transformer and induction motor. • Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears. • Describe corrective and preventive maintenance of electrical equipment's. • Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. 				
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.</p>				
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. 				
Text/ Reference Books				
1	Testing, Commissioning, Operation and Maintenance of Electrical Equipment	S. Rao	Khanna Publishers	6 th Edition, 19 th Reprint, 2015
2	Testing and Commissioning of Electrical Equipment	R.L.Chakrasali	Prism Books Pvt Ltd	1 st Edition, 2014
3	Preventive Maintenance of Electrical Apparatus	S.K.Sharotri	Katson Publishing House	1 st Edition, 1980
4	Handbook of Switchgears	BHEL	McGraw Hill	1 st Edition, 2005
5	Transformers	BHEL	McGraw Hill	1 st Edition, 2003
6	TheJ&P Transformer Book	Martin J. Heathcote	Newnes	12 th Edition, 1998

POWER SYSTEM SIMULATION LABORATORY B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL76	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course objectives:			
To explain the use of MATLAB/C or C ++/Scilab/ Octave/Python software :			
<ul style="list-style-type: none"> • To assess the performance of medium and long transmission lines. • To obtain the power angle characteristics of salient and non- salient pole alternator. • To study transient stability of radial power systems under three phase fault conditions. • To develop admittance and impedance matrices of interconnected power systems. 			
To explain the use of suitable standard software package:			
<ul style="list-style-type: none"> • To solve power flow problem for simple power systems. • To perform fault studies for simple radial power systems. • To study optimal generation scheduling problems for thermal power plants. 			
Sl. No.	Experiments		
1	Use of MATLAB/C or C ++/Scilab/ Octave /Python	Formation for symmetric π /T configuration for Verification of Determination of Efficiency and Regulation.	
2		Determination of Power Angle Diagrams, Reluctance Power, Excitation, Emf and Regulation for Salient and Non-Salient Pole Synchronous Machines.	
3		To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.	
4		Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation and Inspection Method.	
5		Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm.	
6		Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage (Bus) Profile.	
7	Use of Suitable standard software package	Formation of Jacobian for a System not Exceeding 4 Buses (No PV Buses) in Polar Coordinates.	
8		Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses.	
9		To Determine Fault Currents and Voltages in a Single Transmission Line System with Star-Delta Transformers at a Specified Location for LG and LLG faults by simulation.	
10		Optimal Generation Scheduling for Thermal power plants by simulation.	
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		

Course outcomes:

At the end of the course the student will be able to:

- Develop a program in MATLAB to assess the performance of medium and long transmission lines.
- Develop a program in MATLAB to obtain the power angle characteristics of salient and non-salient pole alternator.
- Develop a program in MATLAB to assess the transient stability under three phase fault at different locations in a of radial power systems.
- Develop programs in MATLAB to formulate bus admittance and bus impedance matrices of interconnected power systems.
- Use Mi-Power package to solve power flow problem for simple power systems.
- Use Mi-Power package to study unsymmetrical faults at different locations in radial power systems
- Use of Mi-Power package to study optimal generation scheduling problems for thermal power plants. ■

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - VII**

17EEL76POWER SYSTEM SIMULATION LABORATORY (continued)

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

RELAY AND HIGH VOLTAGE LABORATORY			
B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEL77	CIE Marks	40
Number of Practical Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT levels	L1,L2,L3	Exam Hours	03
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type. • To verify the operation of negative sequencerelay. • To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay. • To conduct experiments on generator, motor and feeder protection. • To conduct experiments to study the sparkover characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • To measure high AC and DC voltages • To experimentally measure the breakdown strength of transformer oil. • To experimentally measure the capacitance of different electrode configuration models using Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■ 			
Sl. NO	Experiments		
Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. Five out of six experiments are to be conducted under Part – D.			
1	Part - A	Over Current Relay: (a)Inverse Definite Minimum Time(IDMT)Non-Directional Characteristics (b) Directional Features (c) IDMT Directional.	
2		IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).	
3		Operation of Negative Sequence Relay.	
4	Part - B	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.	
5		Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.	
6		Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage Relay.	
7	Part - C	Generation Protection: Merz Price Scheme.	
8		Feeder Protection against Faults.	
9		Motor Protection against Faults.	
10	Part - D	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1) : 1993] Configurations: Sphere – Sphere, Point –Plane, Point – Point and Plane – Plane.	
11		Spark Over Characteristics of Air subjected to High voltage DC.	
12		Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005	
13		Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005	
14		Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/ Transmission Line/ Sphere Gap.	
15		(a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.	
Revised Bloom's Taxonomy Level		L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VII
17EEL77 RELAY AND HIGH VOLTAGE LABORATORY (continued)
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Experimentally verify the characteristics of over current, over voltage, under voltage and negative sequence relays both electromagnetic and static type. • Experimentally verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distancerelay. • Show knowledge of protecting generator, motor and feeders. • Analyze the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages. • Measure high AC and DC voltages and breakdown strength of transformer oil. • Draw electric field and measure the capacitance of different electrode configuration models. • Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation.
<p>Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.</p>
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

PROJECT PHASE – I AND SEMINAR			
B.E., VII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEP78	CIE Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Continuous Internal Evaluation			
CIE marks for the project report (50 marks) and seminar (50 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■			

**** END ****

VIII SEMESTER DETAILED SYLLABUS

POWER SYSTEM OPERATION AND CONTROL(Core Course) B.E., VIII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE81	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To describe various levels of controls in power systems and the vulnerability of the system. • To explain components, architecture and configuration of SCADA. • To define unit commitment and explain various constraints in unit commitment and the solution methods • To explain issues of hydrothermal scheduling and solutions to hydro thermal problems • To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control • To explain automatic generation control, voltage and reactive power control in an interconnected power system. • To explain reliability and contingency analysis, state estimation and related issues. ■ 			
Module-1			Teaching Hours
Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centres. Supervisory Control and Data acquisition (SCADA): Introduction to SCADA and its Components, Standard SCADA Configurations, Users of Power Systems SCADA, Remote Terminal Unit for Power System SCADA, Common Communication Channels for SCADA in Power Systems, Challenges for Implementation of SCADA. Unit Commitment: Introduction, Simple Enumeration Constraints, Priority List Method, Dynamic Programming Method for Unit Commitment. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₄ – Analysing.		
Module-2			
Hydro-thermal Scheduling: Introduction, Scheduling Hydro Systems, Discrete Time Interval Method, Short Term Hydro Thermal Scheduling Using $\gamma - \lambda$ Iterations, Short Term Hydro Thermal Scheduling Using Penalty Factors. Automatic Generation Control (AGC): Introductions, Basic Generator Control Loops, Commonly used Terms in AGC, Functions of AGC, Speed Governors. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Automatic Generation Control (continued): Mathematical Model of Automatic Load Frequency Control, AGC Controller, Proportional Integral Controller. Automatic Generation Control in interconnected Power system: Introductions, Tie - Line Control with Primary Speed Control, Frequency Bias Tie - Line Control, State-Space Models. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		
Module-4			
Automatic Generation Control in interconnected Power system (continued): State-Space Model for Two - Area System, Tie-Line Oscillations, Related Issues in Implementation of AGC. Voltage and Reactive Power Control: Introduction, Production and Absorption of Reactive Power, Methods of Voltage Control, Dependence of Voltage on Reactive Power, Sensitivity of Voltage to Changes in P And Q, Cost Saving, Methods of Voltage Control by Reactive Power Injection, Voltage Control Using Transformers, Voltage Stability. ■			10
Revised Bloom's Taxonomy Level	L ₃ – Applying.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
17EE81POWER SYSTEM OPERATION AND CONTROL(Core Course) (continued)				
Module-5				Teaching Hours
Power System Reliability and Security: Introduction, Security Levels of System, Reliability Cost, Adequacy Indices, Functions of System Security, Contingency Analysis, Linear Sensitivity Factors, Contingency Selection and Ranking. State estimation of Power Systems: Introduction, Linear Least Square Estimation, DC State Estimator, Other Issues in State Estimation. ■				10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA. • Solve unit commitment problems • Explain issues of hydrothermal scheduling and solutions to hydro thermal problems • Explain basic generator control loops, functions of Automatic generation control, speed governors • Develop and analyze mathematical models of Automatic Load Frequency Control • Explain automatic generation control, voltage and reactive power control in an interconnected power system. • Explain reliability, security, contingency analysis, state estimation and related issues of power systems. ■ 				
Graduate Attributes (As per NBA) Engineering Knowledge, Problem Analysis, Conduct investigations of complex problems, Modern Tool Usage, Communication, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	Power System Operation and Control	K. Uma Rao	Wiley	1 st Edition, 2012
Reference Books				
1	Power Generation Operation and Control	Allen J Wood et al	Wiley	2nd Edition, 2003
2	Power System Stability and Control	Kundur	McGraw Hill	8 th Reprint, 2009

INDUSTRIAL DRIVES AND APPLICATIONS(Core Course) B.E., VIII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE82	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To define electric drive, its parts, advantages and explain choice of electric drive. • To explain dynamics and modes of operation of electric drives. • To explain selection of motor power ratings and control of dc motor using rectifiers. • To analyze the performance of induction motor drives under different conditions. • To explain the control of induction motor, synchronous motor and stepper motor drives. • To discuss typical applications electrical drives in the industry. ■ 			
Module-1			Teaching Hours
Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Selection of Motor Power Ratings: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating. Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed From Fully Controlled Rectifier, Rectifier Control of dc Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited dc Motor, Chopper Control of Series Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques- Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors. Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER -VIII				
17EE82 INDUSTRIAL DRIVES AND APPLICATIONS(Core Course) (continued)				
Module-5				Teaching Hours
<p>Synchronous Motor Drives (continued):Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless dc Motor Drives.</p> <p>Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor.</p> <p>Industrial Drives:Textile Mills, Steel Rolling Mills, Cranes and Hoists, MachineTools. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the advantages and choice of electric drive. • Explain dynamics and different modes of operation of electric drives. • Suggest a motor for a drive and control of dc motor using controlled rectifiers. • Analyze the performance of induction motor drives under different conditions. • Control induction motor, synchronous motor and stepper motor drives. • Suggest a suitable electrical drive for specific application in the industry. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 				
Textbook				
1	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing House	2 nd Edition, 2001
2	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives under module 5.)	VedumSubrahmanyam	McGraw Hill	2 nd Edition, 2011
Reference Books				
1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1 st Edition, 2009

INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective) B.E., VIII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
■			
Course Code	17EE833	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To explain power generation by alternate energy source like wind power and solar power. • To explain selection of size of units and location for wind and solar systems. • Discuss the effects of integration of distributed generation on the performance the system. 			
Module-1			Teaching Hours
Distributed Generation: Introduction,Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Distributed Generation (continued): Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Overloading and Losses(continued): Increasing the Hosting Capacity. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity. Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance.			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Power Quality Disturbances (continued): Low-Frequency Harmonics, High-Frequency Distortion, Voltage Dips, Increasing the Hosting Capacity. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

Course outcomes:

At the end of the course the student will be able to:

- Explain energy generation by wind power and solar power.

Discuss the variation in production capacity at different timescales, the size of individual units, and the

B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - VIII				
17EE833 INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)(continued)				
Course outcomes (continued):				
<ul style="list-style-type: none"> • Explain the performance of the system when distributed generation is integrated to the system. • Discuss effects of the integration of DG: the increased risk of overload and increased losses. • Discuss effects of the integration of DG: increased risk of overvoltages, increased levels of power quality disturbances. • Discuss effects of the integration of DG: incorrect operation of the protection • Discuss the impact the integration of DG on power system stability and operation. ■ 				
Graduate Attributes (As per NBA)				
Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Conduct investigations of complex problems, Modern Tool Usage, The Engineer and Society, Ethics, Individual and Team Work, Communication, Project Management and Finance, Life-long Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Integration of Distributed Generation in the Power System	Math Bollen	Wiley	2011

INTERNSHIP / PROFESSIONAL PRACTICE B.E., VIII Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EE84	CIE Marks	50
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	50
Credits - 02			
Course objectives:			
<p>Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <ul style="list-style-type: none"> • To put theory into practice. • To expand thinking and broaden the knowledge and skills acquired through course work in the field. • To relate to, interact with, and learn from current professionals in the field. • To gain a greater understanding of the duties and responsibilities of a professional. • To understand and adhere to professional standards in the field. • To gain insight to professional communication including meetings, memos, reading, writing, public 			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p>Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. 			

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.

**B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER - VIII**

17EE84INTERNSHIP / PROFESSIONAL PRACTICE(continued)

Continuous Internal Evaluation

CIE marks for the Internship/Professional practicereport (25 marks)and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman. ■

Semester End Examination

SEE marks for the project report (25 marks)and seminar (25 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

PROJECT WORK PHASE -II			
B.E., VIII Semester, Electrical and Electronics Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EEP85	CIE Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	100
Credits - 06			
Course objectives:			
<ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			
Evaluation Procedure:			
The Internal marks evaluation shall be based on project report and presentation of the same in a seminar.			
Project Report: 50 marks. The basis for awarding the marks shall be the involvement of individual student of the project batch in carrying the project and preparation of project report. To be awarded by the internal guide in consultation with external guide if any.			
Project Presentation: 50 marks. Each student of the project batch shall present the topic of Project Work Phase - II orally and/or through power point slides.			
The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.			
The student shall be evaluated based on:			
Presentation skill for 30 marks and ability in the Question and Answer session for 20 marks. ■			
Semester End Examination			
SEE marks for the project (100 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) as per the University norms by the examiners appointed VTU. ■			

SEMINAR			
B.E., VIII Semester, Electrical and Electronics Engineering			
[As per Choice Based Credit System (CBCS) scheme]			
Course Code	17EES86	CIE Marks	100
Number of Practical Hours/Week	--	Exam Hours	--
Total Number of Practical Hours	--	Exam Marks	--
Credits - 01			
Course objectives:			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.</p> <p>Each student, under the guidance of a Faculty, is required to Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.</p> <ul style="list-style-type: none"> • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Attain, use and develop knowledge in the field of electrical and electronics engineering and other disciplines through independent learning and collaborative study. • Identify, understand and discuss current, real-time issues • Improve oral and written communication skills • Explore an appreciation of the self in relation to its larger diverse social and academic contexts. 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			
Evaluation Procedure:			
<p>The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman.</p> <p>Marks distribution for internal assessment of the course 15EES86 seminar: Seminar Report: 30 marks Presentation skill: 50 marks Question and Answer: 20 marks. ■</p>			



**VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI**



Scheme of Teaching and Examination and Syllabus

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

III-VIII SEMESTER

(Effective from Academic year 2018-19)

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES
(Common to all Programmes)

Course Code	18MAT31	CIE Marks	40
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-transforms.
- To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Solution of linear differential equations using Laplace transforms.

Module-2

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Module-3

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.

Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.

Module-4

Numerical Solutions of Ordinary Differential Equations(ODE's):

Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge -Kutta method of fourth order, Milne's and Adam-Bash forth predictor and corrector method (No derivations of formulae)-Problems.

Module-5

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation, Geodesics, hanging chain, problems.

Course Outcomes: At the end of the course the student will be able to:

- CO1: Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
- CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- CO3: Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
- CO4: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.
- CO5: Determine the externals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				

1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2016
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44 th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3 rd Edition, 2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill Book Co	6 th Edition, 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4 th Edition 2010
3	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill	11 th Edition, 2010
4	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	6 th Edition, 2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018
Web links and Video Lectures:				
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.class-central.com/subject/math(MOOCs) 3. http://academicearth.org/ 4. VTU EDUSAT PROGRAMME - 20 				

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ELECTRIC CIRCUIT ANALYSIS

Course Code	18EE32	CIE Marks	40
Teaching Hours/Week (L: T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To familiarize the basic laws, source transformations, theorems and the methods of analyzing electrical circuits.
- To explain the use of network theorems and the concept of resonance.
- To familiarize the analysis of three-phase circuits, two port networks and networks with non-sinusoidal inputs.
- To explain the importance of initial conditions, their evaluation and transient analysis of R-L and R-C circuits.
- To impart basic knowledge on network analysis using Laplace transforms. ■

Module-1

Basic Concepts: Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super-Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and DC circuits with independent and dependent sources. Duality. ■

Module-2

Network Theorems: Super Position theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Millman's theorem. Analysis of networks, with and without dependent ac and DC sources. ■

Module-3

Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance
Transient Analysis: Transient analysis of RL and RC circuits under DC excitations: Behavior of circuit elements under switching action ($t = 0$ and $t = \infty$), Evaluation of initial conditions. ■

Module-4

Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. ■

Module-5

Unbalanced Three Phase Systems: Analysis of three phase systems, calculation of real and reactive Powers by direct application of mesh and nodal analysis.
Two Port networks: Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits, relationships between parameter sets. ■

Course Outcomes: At the end of the course the student will be able to:

- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.
- Solve complex electric circuits using network theorems.
- Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.
- Synthesize typical waveforms using Laplace transformation.
- Solve unbalanced three phase systems and also evaluate the performance of two port networks. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				

1	Engineering Circuit Analysis	William H Hayt et al	Mc Graw Hill	8th Edition,2014
2	Network Analysis	M.E. Vanvalkenburg	Pearson	3rd Edition,2014
3	Fundamentals of Electric Circuits	Charles K Alexander Matthew N O Sadiku	Mc Graw Hill	5th Edition,2013
Reference Books				
1	Engineering Circuit Analysis	J David Irwin et al	Wiley India	10th Edition, 2014
2	Electric Circuits	Mahmood Nahvi	Mc Graw Hill	5th Edition, 2009
3	Introduction to Electric Circuits	Richard C Dorf and James A Svoboda	Wiley	9 th Edition, 2015
4	Circuit Analysis; Theory and Practice	Allan H Robbins Wilhelm C Miller	Cengage	5 th Edition, 2013
5	Basic Electrical Engineering	V K Mehta, Rohit Mehta	S Chand	6 th Edition 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

TRANSFORMERS AND GENERATORS

Subject Code	18EE33	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of transformers and their analysis.
- To suggest a suitable three phase transformer connection for a particular operation.
- To understand the concepts of generator and to evaluate their performance.
- To explain the requirement for the parallel operation of transformers and synchronous generators. ■

Module-1

Single phase Transformers: Operation of practical transformer under no-load and on-load with phasor diagrams. Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency-commercial and all-day efficiency. Voltage regulation and its significance.

Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation– star/star, delta/delta, star/delta, zigzag/star and V/V, comparative features. Phase conversion-Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, vector groups. ■

Module-2

Tests, Parallel Operation of Transformer & Auto Transformer: Polarity test, Sumpner's test, separation of hysteresis and eddy current losses

Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation– Single phase and three phase. Load sharing in case of similar and dissimilar transformers. **Auto transformers and**

Tap changing transformers: Introduction to autotransformer-copper economy, equivalent circuit, no load and on load tap changing transformers. ■

Module-3

Three-Winding Transformers & Cooling of Transformers: Three-winding transformers. Cooling of transformers.

Direct current Generator: Armature reaction, Commutation and associated problems,

Synchronous Generators: Armature windings, winding factors, e.m.f equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit. ■

Module-4

Synchronous Generators Analysis: Alternator on load. Excitation control for constant terminal voltage. Voltage regulation. Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, synchronous reactance, Voltage regulation by EMF, MMF and ZPF ■

Module-5

Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power, Determination of X_d & X_q – slip test

Performance of Synchronous Generators: Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings. ■

Course Outcomes: At the end of the course the student will be able to:

- Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer.
- Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation.
- Understand the construction and working of AC and DC Generators.
- Analyze the performance of the AC Generators on infinite bus and parallel operation.
- Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Electric Machines	D. P. Kothari, et al	McGraw Hill	4 th Edition, 2011
2	Principals of Electrical Machines	V.K Mehta, Rohit Mehta	S Chand	2 nd edition, 2009

Reference Books

1	Electric Machines	Mulukuntla S.Sarma, et al	Cengage	1 st Edition, 2009
2	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6 th Edition, 2014
3	Electric Machines	Ashfaq Hussain	Dhanpat Rai & Co	2nd Edition, 2013

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ANALOG ELECTRONIC CIRCUITS

Subject Code	18EE34	CIE Marks	40
Number of Lecture Hours/Week	2:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Provide the knowledge for the analysis of diode and transistor circuits.
- Develop skills to design the electronic circuits like amplifiers and oscillators. ■

Module-1

Diode Circuits: Diode clipping and clamping circuits.

Transistor Biasing and Stabilization: Operating point, analysis and design of fixed bias circuit, self-bias circuit, Emitter stabilized bias circuit, voltage divider bias circuit, stability factor of different biasing circuits. Problems. Transistor switching circuits. ■

Module-2

Transistor at Low Frequencies: BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model, relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual. ■

Module-3

Multistage Amplifiers: Cascade and cascade connections, Darlington circuits, analysis and design.

Feedback Amplifiers: Feedback concept, different types, practical feedback circuits, analysis and design of feedback circuits. ■

Module-4

Power Amplifiers: Amplifier types, analysis and design of different power amplifiers, **Oscillators:**

Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability. ■

Module-5

FETs: Construction, working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET. Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers ■

Course Outcomes: At the end of the course the student will be able to:

- Obtain the output characteristics of clipper and clamper circuits.
- Design and compare biasing circuits for transistor amplifiers & explain the transistor switching.
- Explain the concept of feedback, its types and design of feedback circuits
- Design and analyze the power amplifier circuits and oscillators for different frequencies.
- Design and analysis of FET and MOSFET amplifiers. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015
2	Electronic Devices and Circuits	Millman and Halkias	Mc Graw Hill	4th Edition, 2015
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008

Reference Books

1	Microelectronics Circuits Analysis and Design	Muhammad Rashid	Cengage Learning	2 nd Edition, 2014
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2	A Text Book of Electrical Technology, Electronic Devices and Circuits	B.L. Theraja, A.K. Theraja,	S. Chand	Reprint, 2013
3	Electronic Devices and Circuits	Anil K. Maini Vasha Agarval	Wiley	1st Edition, 2009
4	Electronic Devices and Circuits	S.Salivahanan N.Suresh	Mc Graw Hill	3rd Edition, 2013
5	Fundamentals of Analog Circuits	Thomas L Floyd	Pearson	2nd Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

DIGITAL SYSTEM DESIGN

Subject Code	18EE35	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine- McClusky Techniques.
- Design combinational logic circuits.
- Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators
- Describe Latches and Flip-flops, Registers and Counters.
- Analyze Mealy and Moore Models.
- Develop state diagrams, Synchronous Sequential Circuits and to understand the basics of various Memories. ■

Module-1

Principles of Combinational Logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants Tables. ■

Module-2

Analysis and Design of Combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators. ■

Module-3

Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations. ■

Module – 4

Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of a synchronous counter, Design of a synchronous mod-n counter using clocked T, JK, D and SR flip-flops. ■

Module – 5

Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design.

Memories: Read only and Read/Write Memories, Programmable ROM, EPROM, Flash memory. ■

Course Outcomes: After studying this course, students will be able to:

- Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques.
- Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits.
- Design flip flops, counters, shift registers as sequential control circuits.
- Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.
- Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Digital Logic Applications and Design,	John M Yarbrough,	Thomson Learning	2001 ISBN 981-240-062-1.
2	Digital Principles and Design	Donald D. Givone	McGraw Hill	2002 ISBN 978-0-07-052906-9.
Reference Books				
1	Digital Circuits and Design	D. P. Kothari and J. S Dhillon	Pearson	2016, ISBN:9789332543539
2	Digital Design	Morris Mano	Prentice Hall of India	ThirdEdition
3	Fundamentals of logic design	Charles H Roth, Jr.,	Cengage Learning.	Fifth Edition

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ELECTRICAL AND ELECTRONIC MEASUREMENTS (Core Course)

Subject Code	18EE36	CIE Marks	40
Number of Lecture Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To measure resistance, inductance and capacitance using different bridges and determine earth resistance.
- To study the construction and working of various meters used for measurement.
- To study the adjustments, calibration & errors in energy meters and methods of extending the range of instruments. ■

Module-1

Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge.

Earth resistance measurement by fall of potential method and by using Megger.

Measurement of Inductance and Capacitance: Sources and detectors, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. ■

Module-2

Measurement of Power, Energy, Power Factor and Frequency: Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator. ■

Module-3

Extension of Instrument Ranges: Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characteristics, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT.

Magnetic measurements: Introduction, measurement of flux/ flux density, magnetising force and leakage factor. ■

Module-4

Electronic and Digital Instruments: Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (with block diagram), extra features offered by present day meters and their significance in billing. ■

Module-5

Display Devices: Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixies, Incandescent, Fluorescent, Liquid vapour and Visual displays.

Recording Devices: Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and xy recorders. Digital tape recording, Ultraviolet recorders. Electro Cardio Graph (ECG) ■

Course Outcomes: At the end of the course the student will be able to:

- Measure resistance, inductance and capacitance using bridges and determine earth resistance.
- Explain the working of various meters used for measurement of Power, Energy & understand the adjustments, calibration & errors in energy meters.
- Understand methods of extending the range of instruments & instrument transformers.
- Explain the working of different electronic instruments.
- Explain the working of different display and recording devices. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Electrical and electronic Measurements and	A.K. Sawhney	Dhanpat Rai and Co	10th Edition
2	A Course in Electronics and Electrical Measurements and Instrumentation	J. B. Gupta	Katson Books	2013 Edition

Reference Books

1	Electrical and electronic Measurements and	R.K. Rajput	S Chand	5th Edition, 2012
2	Electrical Measuring Instruments and Measurements	S.C. Bhargava	BS Publications	2013
3	Modern Electronic Instrumentation and Measuring Techniques	Cooper D and A.D. Heifrick	Pearson	First Edition, 2015
4	Electronic Instrumentation and Measurements	David A Bell	Oxford University	3rd Edition, 2013
5	Electronic Instrumentation	H.S.Kalsi	Mc Graw Hill	3rd Edition,2010

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ELECTRICAL MACHINES LABORATORY - 1

Subject Code	18EEL37	CIE Marks	40
Number of Practical Hours/Week	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- Conducting of different tests on transformers and synchronous machines and evaluation of their performance.
- Verify the parallel operation of two single phase transformers.
- Study the connection of single phase transformers for three phase operation and phase conversion.
- Study of synchronous generator connected to infinite bus. ■

Sl. No.	Experiments
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and pre-determination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load
4	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5	Comparison of performance of 3 single-phase transformers in delta – delta and V – V (open delta) connection under load.
6	Scott connection with balanced and unbalanced loads.
7	Separation of hysteresis and eddy current losses in single phase transformer.
8	Voltage regulation of an alternator by EMF and MMF methods.
9	Voltage regulation of an alternator by ZPF method.
10	Power angle curve of synchronous generator or Direct load test on three phase synchronous generator to determine efficiency and regulation
11	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.
12	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.

Course Outcomes: At the end of the course the student will be able to:

- Evaluate the performance of transformers from the test data obtained.
- Connect and operate two single phase transformers of different KVA rating in parallel.
- Connect single phase transformers for three phase operation and phase conversion.
- Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory.
- Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

ELECTRONICS LABORATORY

Subject Code	18EEL38	CIE Marks	40
Number of Practical Hours/Week	0:2:0	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To design and test half wave and full wave rectifier circuits.
- To design and test different amplifier and oscillator circuits using BJT.
- To study the simplification of Boolean expressions using logic gates.
- To realize different Adders and Subtractors circuits.
- To design and test counters and sequence generators. ■

Sl. No	Experiments
1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.
2	Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.
3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
4	Design and testing of BJT -RC phase shift oscillator for given frequency of oscillation.
5	Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.
6	Simplification, realization of Boolean expressions using logic gates/Universal gates.
7	Realization of Half/Full adder and Half/Full Subtractors using logic gates.
8	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion and Vice - Versa.
9	Realization of Binary to Gray code conversion and vice versa.
10	Design and testing Ring counter/Johnson counter.
11	Design and testing of Sequence generator.
12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192,

***Note: A minimum of three experiments to be simulated using (Freeware Software Package)**

Course Outcomes: At the end of the course the student will be able to:

- Design and test rectifier circuits with and without capacitor filters.
- Determine h-parameter models of transistor for all modes.
- Design and test BJT and FET amplifier and oscillator circuits.
- Realize Boolean expressions, adders and subtractors using gates.
- Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
 3. Students can pick one experiment from the questions lot prepared by the examiners.
 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
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B. E. (Common to all Programmes)				
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)				
SEMESTER - III				
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (CPC)				
Course Code	18CPC39/49	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	60	
Credits	01	Exam Hours	02	
Course Learning Objectives: To				
<ul style="list-style-type: none"> • know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens • Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society. • Know about the cybercrimes and cyber laws for cyber safety measures. 				
Module-1				
Introduction to Indian Constitution:				
The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.				
Module-2				
Union Executive and State Executive:				
Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370,371,371J) for some States.				
Module-3				
Elections, Amendments and Emergency Provisions:				
Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74, ,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences.				
Constitutional special provisions:				
Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.				
Module-4				
Professional / Engineering Ethics:				
Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering				
Module-5				
Internet Laws, Cyber Crimes and Cyber Laws:				
Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.				
Course Outcomes: On completion of this course, students will be able to,				
CO 1: Have constitutional knowledge and legal literacy.				
CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.				
CO 3: Understand the the cybercrimes and cyber laws for cyber safety measures.				
Question paper pattern for SEE and CIE:				
<ul style="list-style-type: none"> • The SEE question paper will be set for 100 marks and the marks scored by the students will proportionately be reduced to 60. The pattern of the question paper will be objective type (MCQ). • For the award of 40 CIE marks, refer the University regulations 2018. 				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year

Textbook/s				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, and et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
3	Introduction to the Constitution of India	Durga Das Basu	Prentice –Hall,	2008.
4	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice –Hall,	2004

B. E. (Common to all Programmes)				
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)				
SEMESTER - III				
ADDITIONAL MATHEMATICS – I				
(Mandatory Learning Course: Common to All Programmes)				
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech. programmes)				
Course Code	18MATDIP31	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60	
Credits	0	Exam Hours	03	
Course Learning Objectives:				
<ul style="list-style-type: none"> To provide basic concepts of complex trigonometry, vector algebra, differential and integral calculus. To provide an insight into vector differentiation and first order ODE's. 				
Module-1				
<p>Complex Trigonometry: Complex Numbers: Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof).</p> <p>Vector Algebra: Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.</p>				
Module-2				
<p>Differential Calculus: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.</p>				
Module-3				
<p>Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.</p>				
Module-4				
<p>Integral Calculus: Review of elementary integral calculus. Reduction formulae for $\sin^n x$, $\cos^n x$ (with proof) and $\sin^m x \cos^n x$ (without proof) and evaluation of these with standard limits-Examples. Double and triple integrals-Simple examples.</p>				
Module-5				
<p>Ordinary differential equations (ODE's). Introduction-solutions of first order and first-degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.</p>				
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> CO1: Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area. CO2: Use derivatives and partial derivatives to calculate rate of change of multivariate functions. CO3: Analyze position, velocity and acceleration in two and three dimensions of vector valued functions. CO4: Learn techniques of integration including the evaluation of double and triple integrals. CO5: Identify and solve first order ordinary differential equations. 				
Question paper pattern:				
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question will be for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module. Each full question will have sub- question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 				
Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	43 rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015
2	Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2007
3	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	1 st Edition, 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - IV				
COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS (Common to all programmes)				
Course Code	18MAT41	CIE Marks	40	
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	60	
Credits	03	Exam Hours	03	
Course Learning Objectives:				
<ul style="list-style-type: none"> To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory. To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering. 				
Module-1				
Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.				
Construction of analytic functions: Milne-Thomson method-Problems.				
Module-2				
Conformal transformations: Introduction. Discussion of transformations: $w = Z^2, w = e^z, w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems.				
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.				
Module-3				
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.				
Module-4				
Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression -problems.				
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b, y = ax^b$ and $y = ax^2 + bx + c$.				
Module-5				
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.				
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.				
Course Outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data. Construct joint probability distributions and demonstrate the validity of testing the hypothesis. 				
Question paper pattern:				
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question will be for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module. 				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2016
2	Higher Engineering	B. S. Grewal	Khanna Publishers	44 th Edition, 2017

	Mathematics			
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3 rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C. Ray Wylie, Louis C. Barrett	McGraw-Hill	6 th Edition 1995
2	Introductory Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India	4 th Edition 2010
3	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill	11 th Edition,2010
4	A Text Book of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	2014
5	Advanced Engineering Mathematics	Chandrika Prasad and Reena Garg	Khanna Publishing,	2018
Web links and Video Lectures:				
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.class-central.com/subject/math(MOOCs) 3. http://academicearth.org/ 4. VTU EDUSAT PROGRAMME - 20 				

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

POWER GENERATION AND ECONOMICS

Subject Code	18EE42	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Explain the arrangement and operation of hydroelectric, steam, diesel, gas turbine and nuclear power plants and working of major equipment in the plants.
- Classification of substation and explain the operation of different substation equipment.
- Explain the importance of grounding and different grounding methods used in practice.
- Explain the economics of power generation and importance of power factor. ■

Module-1

Hydroelectric Power Plants: Hydrology, run off and stream flow, hydrograph, flow duration curve, Mass curve, reservoir capacity, dam storage. Hydrological cycle, merits and demerits of hydroelectric power plants, Selection of site. General arrangement of hydel plant, elements of the plant, Classification of the plants based on water flow regulation, water head and type of load the plant has to supply. Water turbines – Pelton wheel, Francis, Kaplan and propeller turbines. Characteristic of water turbines Governing of turbines, selection of water turbines. Underground, small hydro and pumped storage plants. Choice of size and number of units, plant layout and auxiliaries. ■

Module-2

Steam Power Plants: Introduction, Efficiency of steam plants, Merits and demerits of plants, selection of site. Working of steam plant, Power plant equipment and layout, Steam turbines, Fuels and fuel handling, Fuel combustion and combustion equipment, Coal burners, Fluidized bed combustion, Combustion control, Ash handling, Dust collection, Draught systems, Feed water, Steam power plant controls, plant auxiliaries.

Diesel Power Plant: Introduction, Merits and demerits, selection site, elements of diesel power plant, applications.

Gas Turbine Power Plant: Introduction Merits and demerits, selection site, Fuels for gas turbines, Elements of simple gas turbine power plant, Methods of improving thermal efficiency of a simple steam power plant, Closed cycle gas turbine power plants. Comparison of gas power plant with steam

Module-3

Nuclear Power Plants: Introduction, Economics of nuclear plants, Merits and demerits, selection of site, Nuclear reaction, Nuclear fission process, Nuclear chain reaction, Nuclear energy, Nuclear fuels, Nuclear plant and layout, Nuclear reactor and its control, Classification of reactors, power reactors in use, Effects of nuclear plants, Disposal of nuclear waste and effluent, shielding. ■

Module-4

Substations: Introduction to Substation equipment; Transformers, High Voltage Fuses, High Voltage Circuit Breakers and Protective Relaying, High Voltage Disconnect Switches, Lightning Arresters, High Voltage Insulators and Conductors, Voltage Regulators, Storage Batteries, Reactors, Capacitors, Measuring Instruments, and power line carrier communication equipment. Classification of substations – indoor and outdoor, Selection of site for substation, Bus-bar arrangement schemes and single line diagrams of substations. ■

Substations (continued): Interconnection of power stations. Introduction to gas insulated substation, Advantages and economics of Gas insulated substation.

Grounding: Introduction, Difference between grounded and ungrounded system. System grounding – ungrounded, solid grounding, resistance grounding, reactance grounding, resonant grounding. Earthing transformer. Neutral grounding and neutral grounding transformer. ■

Module-5

Economics: Introduction, Effect of variable load on power system, classification of costs, Cost analysis. Interest and Depreciation, Methods of determination of depreciation, Economics of Power generation, different terms considered for power plants and their significance, load sharing. Choice of size and number of generating plants. Tariffs, objective, factors affecting the tariff, types. Types of consumers and their tariff. Power factor, disadvantages, causes, methods of improving power factor. Advantages of improved power factor, economics of power factor improvement and comparison of methods of improving the power factor. Choice of equipment. ■

Course Outcomes: At the end of the course the student will be able to:

- Describe the working of hydroelectric, steam, nuclear power plants and state functions of major equipment of the power plants.
- Classify various substations and explain the functions of major equipments in substations.
- Explain the types of grounding and its importance.
- Infer the economic aspects of power system operation and its effects.
- Explain the importance of power factor improvement. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Power Plant Engineering	P.K. Nag	McGrawHill	4 th Edition, 2014
2	Generation of Electrical Energy	B.R.Gupta	S. Chand	2015
3	Electrical power Generation, Transmission and Distribution	S.N. Singh	PHI	2 nd Edition, 2009

Reference Books

1	A Course in Power Systems	J.B. Gupta	Katson	2008
2	Electrical Power Distribution Systems	V. Kamaraju	McGrawHill	1 st Edition, 2009
3	A Text Book on Power System Engineering	A.Chakrabarti, et al	DhanpathRai	2 nd Edition, 2010
4	Electrical Distribution Engineering	Anthony J. Pansini	CRC Press	3 rd Edition, 2006
5	Electrical Distribution Systems	Dale R PatrickEt al	CRC Press	2 nd Edition, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

TRANSMISSION AND DISTRIBUTION

Course Code	18EE43	CIE Marks	40
Number of Lecture Hours/Week	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of various methods of generation of power.
- To understand the importance of HVAC, EHVAC, UHVAC and HVDC transmission.
- To design insulators for a given voltage level.
- To calculate the parameters of the transmission line for different configurations and assess the performance of the line.
- To study underground cables for power transmission and evaluate different types of distribution systems. ■

Module-1

Introduction to Power System: Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.

Overhead Transmission Lines: A brief introduction to types of supporting structures and line conductors-Conventional conductors; Aluminium Conductor steel reinforced (ACSR), All – aluminium alloy conductor (AAAC) and All –aluminium conductor (AAC). High temperature conductors; Thermal resistant aluminium alloy (ATI), Super thermal resistant aluminium alloy (ZTAI), Gap type thermal resistant aluminium alloy conductor steel reinforced (GTACSR), Gap type super thermal resistant aluminium alloy conductor steel reinforced (GZTACSR). Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightning; ground wires.

Overhead Line Insulators: A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency. Arcing horns. ■

Module-2

Line Parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines.). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Capacitance of composite – conductor, geometric mean radius (GMR) and geometric mean distance (GMD). Advantages of single circuit and double circuit lines. ■

Module-3

Performance of Transmission Lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases. ■

Module-4

Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.

Underground Cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables. Specification of power cables. ■

Module-5

Distribution: Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated loads. Effect of disconnection of neutral in a 3 phase four wire system.

Reliability and Quality of Distribution System: Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators.
- Analyze and compute the parameters of the transmission line for different configurations.
- Assess the performance of overhead lines.
- Interpret corona, explain the use of underground cables.
- Classify different types of distribution systems; examine its quality & reliability. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	A Course in Electrical Power	Soni Gupta and	Dhanpat Rai	-
2	Principles of Power System	V.K. Mehta, Rohit Mehta	S. Chand	1 st Edition 2013

Reference Books:

1	Power System Analysis and Design	J. Duncan Glover et al	Cengage Learning	4th Edition 2008
2	Electrical power Generation, Transmission	S.N. Singh	PHI	2 nd Edition, 2009
3	Electrical Power	S.L. Uppal	Khanna Publication	
4	Electrical power systems	C. L. Wadhwa	New Age	5 th Edition,
5	Electrical power systems	Ashfaq Hussain	CBS Publication	
6	Electric Power Distribution	A.S. Pabla	McGraw-Hill	6 th Edition, 2012

For High temperature conductors refer www.jpowers.co.jp/english/product/pdf/gap_c1.pdf and [Power](#)

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ELECTRIC MOTORS

Course Code	18EE44	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To study the constructional features of Motors and select a suitable drive for specific application.
- To study the constructional features of Three Phase and Single phase induction Motors.
- To study different test to be conducted for the assessment of the performance characteristics of motors.
- To study the speed control of motor by a different methods.
- Explain the construction and operation of Synchronous motor and special motors. ■

Module-1

DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point.

Losses and Efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. ■

Module-2

Testing of DC Motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests.

Three Phase Induction Motors: Review of concept and generation of rotating magnetic field. Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip. ■

Module-3

Performance of Three-Phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator. ■

Module-4

Starting and Speed Control of Three-Phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods

Single-Phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. ■

Module-5

Synchronous Motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors.

Other Motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor and stepper motors. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the construction, operation and classification of DC Motor, AC motor and Special purpose motors.
- Describe the performance characteristics & applications of Electric motors.
- Demonstrate and explain the methods of testing of DC machines and determine losses and efficiency.
- Control the speed of DC motor and induction motor.
- Explain the starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and damping of synchronous motors. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	Electric Machines	D. P. Kothari, I. J. Nagrath	McGraw Hill	4th edition, 2011
2	Theory of Alternating Current Machines	Alexander Langsdorf	McGraw Hill	2nd Edition, 2001
3	Electric Machines	Ashfaq Hussain	Dhanpat Rai & Co	2nd Edition, 2013

Reference Books:

1	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
2	Electrical Machines	M.V. Deshpande	PHI Learning	2013
3	Electric Machinery and Transformers	Bhag S Guru at el	Oxford University Press	3 rd Edition, 2012
4	Electric Machinery and Transformers	Irving Kosow	Pearson	2nd Edition, 2012
5	Principles of Electric Machines and	P.C.Sen	Wiley	2nd Edition, 2013
6	Electric Machines	R.K. Srivastava	Cengage Learning	2nd Edition, 2013

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ELECTROMAGNETIC FIELD THEORY

Course Code	18EE45	CIE Marks	40
Number of Lecture Hours/Week	2:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To study different coordinate systems for understanding the concept of gradient, divergence and curl of a vector.
- To study the application of Coulomb's Law and Gauss Law for electric fields produced by different charge configurations.
- To evaluate the energy and potential due to a system of charges.
- To study the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics.
- To study the magnetic fields and magnetic materials.
- To study the time varying fields and propagation of waves in different media. ■

Module-1

Vector Analysis: Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Numerical.

Electrostatics: Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Numerical ■

Module-2

Energy and Potential: Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Numerical.

Conductor and Dielectrics: Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Numerical. ■

Module-3

Poisson's and Laplace Equations: Derivations and problems, Uniqueness theorem.

Steady magnetic fields: Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Numerical. ■

Module-4

Magnetic forces: Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Numerical.

Magnetic Materials and Magnetism: Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Numerical. ■

Module-5

Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Numerical.

Uniform plane wave: Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Numerical. ■

Course Outcomes: At the end of the course the student will be able to:

- Use different coordinate systems, Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.
- Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions.
- Explain the Poisson's, Laplace equations and behavior of steady magnetic fields.
- Explain the behavior of magnetic fields and magnetic materials.
- Asses time varying fields and propagation of waves in different media. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	Engineering Electromagnetics	William H Hayt et al	McGraw Hill	8 th Edition, 2014
2	Principles of Electromagnetics	Matthew N. O. Sadiku	Oxford	6 th Edition, 2015

Reference Books:

1	Fundamentals of Engineering Electromagnetics	David K. Cheng	Pearson	2014
2	Electromagnetism -Theory (Volume -1) -Applications (Volume-2)	AshutoshPramanik	PHI Learning	2014
3	Electromagnetic Field Theory Fundamentals	Bhag Guru et al	Cambridge	2005
4	Electromagnetic Field Theory	RohitKhurana	Vikas Publishing	1 st Edition,2014
5	Electromagnetics	J. A. Edminister	McGraw Hill	3 rd Edition, 2010
6	Electromagnetic Field Theory and Transmission Lines	GottapuSasibhushana Rao	Wiley	1st Edition, 2013

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

OPERATIONAL AMPLIFIERS AND LINEAR ICs

Course Code	18EE46	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the basics of Linear ICs such as Op-amp, Regulator, Timer & PLL.
- To learn the designing of various circuits using linear ICs.
- To use these linear ICs for specific applications.
- To understand the concept and various types of converters.
- To use these ICs, in Hardware projects.

Module-1

Operational Amplifiers: Introduction, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback(excluding derivations).

General Linear Applications: A.C. amplifier, summing, scaling & averaging amplifier, inverting and non-inverting configuration, Instrumentation amplifier. ■ **T1**

Module-2

Active Filters: First & Second order high pass & low pass Butterworth filters. Band pass filters, all pass filters.

DC Voltage Regulators: voltage regulator basics, voltage follower regulator, adjustable output regulator, LM317 & LM337 Integrated circuits regulators. ■ **T1**

Module-3

Signal Generators: Triangular / rectangular wave generator, phase shift oscillator, saw tooth oscillator.

Comparators & Converters: Basic comparator, zero crossing detector, inverting & non-inverting Schmitt trigger circuit, voltage to current converter with grounded load, current to voltage converter and basics of voltage to frequency and frequency to voltage converters. ■ **T1**

Module-4

Signal processing circuits: Precision half wave & full wave rectifiers

A/D & D/A Converters: Basics, R–2R D/A Converter, Integrated circuit 8-bit D/A, successive approximation ADC, linear ramp ADC ■ **R1**

Module-5

Phase Locked Loop (PLL): Basic PLL, components, performance factors.

Timer: Internal architecture of 555 timer, Mono stable multivibrators and applications. ■ **T1**

Course Outcomes: At the end of the course the student will be able to:

- Describe the characteristics of ideal and practical operational amplifier.
- Design filters and signal generators using linear ICs.
- Demonstrate the application of Linear ICs as comparators and rectifiers.
- Analyze voltage regulators for given specification using op-amp and IC voltage regulators.
- Summarize the basics of PLL and Timer. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	Op-Amps and Linear Integrated Circuits	Ramakant A Gayakwad	Pearson	4 th Edition 2015
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Reference Books:

1	Operational Amplifiers and Linear ICs	David A. Bell	Oxford	3 rd Edition 2011
2	Linear Integrated Circuits; Analysis, Design and	B. Somanthan Nair	Wiley India	2013
3	Linear Integrated Circuits	S. Salivahanan, et al	McGraw Hill	2 nd Edition, 2014
4	Operational Amplifiers and Linear Integrated Circuits	K. Lal Kishore	Pearson	1 st Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

ELECTRICAL MACHINES LABORATORY - 2

Course Code	18EEL47	CIE Marks	40
Number of Practical Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To perform tests on DC machines to determine their characteristics. • To control the speed of DC motor. • To conduct test for pre-determination of the performance characteristics of DC machines • To conduct load test on single phase and three phase induction motor. • To conduct test on induction motor to determine the performance characteristics. • To conduct test on synchronous motor to draw the performance curves. ■ 			
S No.	Experime		
1	Load test on DC shunt motor to draw speed–torque and horse power–efficiency characteristics.		
2	Field Test on DC series machines.		
3	Speed control of DC shunt motor by armature and field control.		
4	Swin burne's Test on DC motor.		
5	Retardation test on DC shunt motor.		
6	Regenerative test on DC shunt machines.		
7	Load test on three phase induction motor.		
8	No-load and Blocked rotor test on three phase induction motor to draw(i)equivalent circuit and(ii)circle diagram. Determination of performance parameters at different load conditions		
9	Load test on induction generator.		
10	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.		
11	Conduct suitable tests to draw thee equivalent circuit of single phase induction motor and determine performance parameters.		
12	Conduct an experiment to draw v and Inverted curves of synchronous motor at no load and load conditions.		
Course Outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Test DC machines to determine their characteristics and also to control the speed of DC motor. • Pre-determine the performance characteristics of DC machines by conducting suitable tests. • Perform load test on single phase and three phase induction motor to assess its performance. • Conduct test on induction motor to pre-determine the performance characteristics. • Conduct test on synchronous motor to draw the performance curves. ■ 			
Conduct of Practical Examination:			
<ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners. 3. Students can pick one experiment from the questions lot prepared by the examiners. 4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made 			

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - IV

OP- AMP AND LINEAR ICS LABORATORY

Course Code	18EEL48	CIE Marks	40
Number of Practical Hours/Week	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To conduct different experiments using OP-Amps
- To conduct experiments using Linear IC's

a) Study of pin details, specifications, application features of IC741 (LM741) and IC555 (Timer) through corresponding datasheets (Datasheets are instruction manuals for electronic components. They explain exactly what a component does and how to use it.).

b) Comparison of output performance quantity of an Operational Amplifier obtained by rigging up the circuit with the ideal value of

(i) A Non-Inverting Amplifier ($V_{out}=AV_{in}$) (ii) An Inverting Amplifier ($V_{out}=-AV_{in}$) (iii) A Difference Amplifier ($V_{out}=-A(V_p-V_{in})$) (iv) A Difference Amplifier with floating inputs

($V_{out}=AV_{in}$) (v) A Non – Inverting Amplifier with negative feedback (ii) An Inverting Amplifier with negative and output transfer characteristics to analyse and conclude that op-amps are rarely used in open-loop.

c) Plot of input and output transfer characteristics to analyse and conclude that op-amps are rarely used in open-loop.

d) Testing of op – amp.

Sl. No	Experiments
1	Design and verify a precision full wave rectifier. Determine the performance parameters.
2	Design and realize to analyse the frequency response of an op – amp amplifier under inverting and non - inverting configuration for a given gain.
3	Design and verify the output waveform of an op – amp RC phase shift oscillator for a desired frequency.
4	Design and realize Schmitt trigger circuit using an op – amp for desired upper trip point (UTP) and lower trip point (LTP).
5	Verify the operation of an op – amp as (a) voltage comparator circuit and (b) zero crossing detector.
6	Design and verify the operation of op – amp as an (a) adder (b) subtractor (c) integrator and (d) differentiator.
7	Design and realize an op – amp based first order Butterworth (a) low pass (b) high pass and (c) band pass filters for a given cut off frequency/frequencies to verify the frequency response characteristic.
8	Design and realize an op – amp based function generator to generate sine, square and triangular waves of desired frequency.
9	Design and realization of R-2R ladder DAC.
10	Realization of Two bit Flash ADC
11	Design and verify an IC 555 timer based pulse generator for the specified pulse.
12	Designing of Fixed voltage power supply (voltage regulator) using IC regulators 78 series and 79 series.

Course Outcomes: At the end of the course the student will be able to:

- To conduct experiment to determine the characteristic parameters of OP-Amp
- To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator.
- To design test the OP-Amp as oscillators and filters.
- Design and study of Linear IC's as multivibrator power supplies.

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Note: Also verify the results of any four experiments using standard simulation package.

B.E.(Common to all Programmes)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - IV

ADDITIONAL MATHEMATICS – II

(Mandatory Learning Course: Common to All Programmes)
(A Bridge course for Lateral Entry students under Diploma quota to BE/B. Tech. programmes)

Course Code	18MATDIP41	CIE Marks	40
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	60
Credits	0	Exam Hours	03

Course Learning Objectives:

- To provide essential concepts of linear algebra, second & higher order differential equations along with methods to solve them.
- To provide an insight into elementary probability theory and numerical methods.

Module-1

Linear Algebra: Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.

Module-2

Numerical Methods: Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)- Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.

Module-3

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators.[*Particular Integral restricted to $R(x) = e^{ax}$, $\sin ax$ / $\cos ax$ for $f(D)y = R(x)$.]*

Module-4

Partial Differential Equations(PDE's):- Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

Module-5

Probability: Introduction. Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes's theorem, problems.

Course Outcomes: At the end of the course the student will be able to:

- CO1: Solve systems of linear equations using matrix algebra.
- CO2: Apply the knowledge of numerical methods in modelling and solving engineering problems.
- CO3: Make use of analytical methods to solve higher order differential equations.
- CO4: Classify partial differential equations and solve them by exact methods.
- CO5: Apply elementary probability theory and solve related problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition, 2015
Reference Books				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 th Edition, 2015

2	Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publishers	7th Edition, 2007
3	Engineering Mathematics Vol. I	Rohit Khurana	Cengage Learning	1 st Edition, 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	18EE51	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process. • To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business. • To explain need of coordination between the manager and staff, the social responsibility of business and leadership. • To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship. • To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs • To discuss the importance of Small Scale Industries and the related terms and problems involved. • To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan. • To introduce the concepts of project management and discuss capital building process. • To explain project feasibility study and project appraisal and discuss project financing • To discuss about different institutions at state and central levels supporting business enterprises. ■ 			
Module-1			
<p>Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession.</p> <p>Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. ■</p>			
Module-2			
<p>Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.</p> <p>Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling. ■</p>			
Module-3			
<p>Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for</p>			
Module-4			
<p>Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).</p> <p>Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions. ■</p>			
Module-5			

Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.

New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM .■

Course Outcomes: At the end of the course the student will be able to:

- Explain the field of management, task of the manager, planning and steps in decision making.
- Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.
- Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.
- Show an understanding of role of SSI's in the development of country and state/central level institutions/agencies supporting business enterprises.
- Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Principles of Management	P.C.Tripathi, P.N.Reddy	McGraw Hill,	6 th Edition, 2017
2	Entrepreneurship Development And Small Business Enterprises	Poornima M.Charanthimath	Pearson	2 nd Edition,2014

Reference Books

1	Dynamics of Entrepreneurial Development and Management	Vasant Desai	Himalaya Publishing House	2007
2	Essentials of Management: An International, Innovation and Leadership	Harold Koontz, Heinz Weihrich	McGraw Hill	10 th Edition 2016

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MICROCONTROLLER

Course Code	18EE52	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic,

Module-1

8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes. ■

Module-2

Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. ■

Module-3

8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C

8051 Timer Programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C. ■

Module-4

8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C.

8051 Interrupt Programming in Assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C. ■

Module-5

Interfacing: LCD interfacing, Keyboard interfacing.

ADC, DAC and Sensor Interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.

Motor Control: Relay, PWM, DC and Stepper Motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM.

8051 Interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255. ■

Course Outcomes: At the end of the course the student will be able to:

- Outline the 8051 architecture, registers, internal memory organization, addressing modes.
- Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.
- Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming.
- Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming.
- Program 8051 to work with external devices for ADC, DAC, Stepper motor control, DC motor control, Elevator control. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazadi	Pearson	2 nd Edition, 2008.
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Reference Books

1	The 8051 Microcontroller	Kenneth Ayala	Cengage Learning	3 rd Edition, 2005
2	The 8051 Microcontroller and Embedded Systems	Manish K Patel	McGraw Hill	2014
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	1 st Edition, 2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

POWER ELECTRONICS

Course Code	18EE53	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics.
- To explain power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics and limitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

Module-1

Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches.

Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes ,Freewheeling diodes with RL load.

Diode Rectifiers: Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load . ■ **T1 & R1**

Module-2

Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers. ■ **T1**

Module-3

Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, di/dt Protection, dv/dt Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor. ■ **T1**

Module-4

Controlled Rectifiers: Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase dual Converters.

AC Voltage Controllers: Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers. ■ **T1 & R1**

Module-5

DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification.

DC-AC Converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters. ■ **T1**

Course Outcomes: At the end of the course the student will be able to:

- To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, their steady state and switching characteristics and limitations.
- To explain different types of Thyristors, their gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid,	Pearson	4th Edition, 2014
Reference Books				
1	Power Electronics	P.S. Bimbhra	Khanna Publishers	5th Edition, 2012
2	Power Electronics: Converters, Applications	Ned Mohan et al	Wiley	3rd Edition, 2014
3	Power Electronics	Daniel W Hart	McGraw Hill	1 st Edition, 2011
4	Elements of Power Electronics	Philip T Krein	Oxford	Indian Edition, 2008

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - V

SIGNALS AND SYSTEMS

Course Code	18EE54	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss arising of signals in different systems.
- To classify the signals and define certain elementary signals.
- To explain basic operations on signals and properties of systems.
- To explain the use of convolution integral and convolution summation in analyzing the response of linear time invariant systems in continuous and discrete time domains.
- To explain the properties of linear time invariant systems in terms of impulse response description.
- To explain determination of response of a given linear time invariant system and to provide a block diagram representation to it.
- To explain Fourier transform representation of continuous time and discrete time non-periodic signals and the properties of Fourier Transforms.
- To explain the applications of Fourier transform representation to study signals and linear time invariant systems. To explain the use of Z-transform in the complex exponential representation of discrete time signals and the analysis of systems. ■

Module-1

Introduction: Definitions of signals and a system, classification of signals, basic operations on signals. Elementary signals viewed as interconnections of operations, properties of systems ■

Module-2

Time – Domain Representations for LTI Systems: Convolution, impulse response, properties, solution of differential and difference equations, block diagram representation. ■

Module-3

The Continuous-Time Fourier Transform: Representation of a non-periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations. ■

Module-4

The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier transform (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of difference equations. ■

Module-5

Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the generation of signals, behavior of system and the basic operations that can be performed on signals and properties of systems.
- Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.
- Solve the continuous time and discrete time systems by various methods and their representation by block diagram.
- Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
- Apply Z-transform and properties of Z transform for the analysis of discrete time systems. ■

Question paper pattern:

- The question paper will have ten questions.
 - Each full question is for 20 marks.
 - There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
 - Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Signals and Systems	Simon Haykin, Berry Van Veen	Wiley	2 nd Edition,2002
Reference Books				
1	Fundamentals of Signals and Systems	Michael J. Roberts, Govind K Sharma	McGraw Hill	2 nd Edition 2010
2	Signals and Systems	NagoorKani	McGraw Hill	1 st Edition 2010
3	Signals and Systems A Primer with MATLAB	Matthew N.O. Sadiku Warsame H. Ali	CRC Press	1 st Edition, 2016
4	Signals and Systems	Anand Kumar	PHI	3 rd Edition, 2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - V

ELECTRICAL MACHINE DESIGN (Core Course)

Course Code	18EE55	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines.
- To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines.
- To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines.
- To discuss the selection of specific loadings, for various machines.
- To discuss separation of main dimensions for different electrical machines
- To discuss design of field windings for DC machines and synchronous machines. To evaluate the performance parameters of transformer, induction motor.
- To design of cooling tubes for the transformer for a given temperature rise.
- To explain design of rotor of squirrel cage rotor and slip ring rotor.
- To define short circuit ratio and discuss its effect on machine performance. ■

Module-1

Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration. ■

Module-2

Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. ■

Module-3

Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes. ■

Module-4

Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance. ■

Module-5

Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non-salient Pole Rotors. Magnetic Circuit and Field Winding. ■

Course Outcomes: At the end of the course the student will be able to:

- Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.
- Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine.
- Derive the output equations of transformer, discuss selection of specific loadings, estimate the number of cooling tubes, no load current and leakage reactance of core type transformer.
- Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor.
- Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	A course in Electrical Machine	A.K.Sawhney	DhanpatRai	6 th Edition, 2013
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Reference Books

1	Performance and Design of Alternating Current Machines	M.G. Say	CBS Publisher	3 rd Edition, 2002
2	Design Data Handbook	A. Sanmugasundaram Et al	New Age International	1 st Edition, 2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - V

HIGH VOLTAGE ENGINEERING

Course Code	18EE56	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Credits - 03

Course Learning Objectives:

- To discuss conduction and breakdown in gases, liquid dielectrics.
- To discuss breakdown in solid dielectrics.
- To discuss generation of high voltages and currents and their measurement.
- To discuss overvoltage phenomenon and insulation coordination in electric power systems. ■

Module-1

Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ , Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges. **Conduction and Breakdown in Liquid Dielectrics:** Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. **Breakdown in Solid Dielectrics:** Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown. ■

Module-2

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators. ■

Module-3

Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. ■

Module-4

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems: National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems. ■

Module-5

Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.
High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain conduction and breakdown phenomenon in gases, liquid dielectrics and breakdown phenomenon in solid dielectrics.
- Summarize generation of high voltages and currents
- Outline measurement techniques for high voltages and currents.
- Summarize overvoltage phenomenon and insulation coordination in electric power systems.
- Explain non-destructive testing of materials and electric apparatus, high-voltage testing of electric apparatus ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	High Voltage Engineering	M.S. Naidu, V.Kamaraju	McGraw Hill	5 th Edition, 2013.
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Reference Books

1	High Voltage Engineering Fundamentals	E. Kuffel, W.S. Zaengl, J. Kuffel	Newnes	2 nd Edition, 2000
2	High Voltage Engineering	Wadhwa C.L.	New Age International	3 rd Edition, 2012
3	High-Voltage Test and Measuring Techniques	Wolfgang Hauschild Eberhard Lemke	Springer	1 st Edition 2014
4	High Voltage Engineering	Farouk A.M. Rizk	CRC Press	1 st Edition 2014
5	Fundamental of High Voltage Engineering	Ravindra Arora, Bharat Singh Rajpurohit	Wiley	2019

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

MICROCONTROLLER LABORATORY

Course Code	18EEL57	CIE Marks	40
Number of Practical Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	3

Course Learning Objectives:

- To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
- To explain writing assembly language programs for code conversions.
- To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- To perform interfacing of stepper motor and DC motor for controlling the speed.
- To explain generation of different waveforms using DAC interface. ■

Sl. No.	Experiments
Note: For the experiments 1 to 6, 8051 assembly programming is to be used.	
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube operations for
3	Counters
4	Boolean and logical instructions (bit manipulation).
5	Conditional call and return instructions.
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to ASCII, Hexa
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.	
8	Stepper motor interface.
9	DC motor interface for direction and speed control using PWM.
10	Alphanumeric LCD panel interface.
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.
12	External ADC and Temperature control interface.
13	Elevator interface.

Course Outcomes: At the end of the course the student will be able to:

- Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions and code conversions.
- Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
- Perform interfacing of stepper motor and dc motor for controlling the speed, elevator, LCD, external ADC and temperature control.
- Generate different waveforms using DAC interface.
- Work with a small team to carryout experiments using microcontroller concepts and prepare reports that present lab work. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

POWER ELECTRONICS LABORATORY

Course Code	18EEL5	CIE Marks	40
Number of Practical Hours/Week (L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To conduct experiments on semiconductor devices to obtain their static characteristics.
- To study different methods of triggering the SCR
- To study the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- To control the speed of a DC motor, universal motor and stepper motors.
- To study single phase full bridge inverter connected to resistive load. ■

Sl. No	Experiments
1	Static Characteristics of SCR.
2	Static Characteristics of MOSFET and IGBT.
3	Characteristic of TRIAC.
4	SCR turn on circuit using synchronized UJT relaxation oscillator.
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.
6	Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without free wheeling diode
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8	Speed control of DC motor using single semi converter.
9	Speed control of stepper motor.
10	Speed control of universal motor using ac voltage regulator.
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12	Single phase MOSFET/IGBT based PWM inverter.

Course Outcomes: At the end of the course the student will be able to:

- Obtain static characteristics of semiconductor devices to discuss their performance.
- Trigger the SCR by different methods
- Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- Control the speed of a DC motor, universal motor and stepper motors.
- Verify the performance of single phase full bridge inverter connected to resistive load. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	18CIV59	CIE Marks	40
Teaching Hours / Week (L:T:P)	(1:0:0)	SEE Marks	60
Credits	01	Exam Hours	02

Module - 1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module - 2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module - 3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module - 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module - 5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

Course Outcomes: At the end of the course, students will be able to:

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Question paper pattern:

- The Question paper will have 100 objective questions.
- Each question will be for 01 marks
- Student will have to answer all the questions in an OMR Sheet.
- The Duration of Exam will be 2 hours.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook/s				
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2 nd Edition, 2012
2.	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3 rd Edition 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
Reference Books				
1	Principals of Environmental	Raman Sivakumar	Cengage learning,	2 nd Edition, 2005

	Science and Engineering		Singapur.	
2	Environmental Science – working with the Earth	G.Tyler Miller Jr.	Thomson Brooks /Cole,	11 th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh& Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1 st Edition

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - VI			
CONTROL SYSTEMS (Core Subject)			
Course Code	18EE61	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To define a control system • To explain the necessity of feedback and types of feedback control systems. • To introduce the concept of transfer function and its application the modeling of linear systems. • To demonstrate mathematical modeling of control systems. • To obtain transfer function of systems through block diagram manipulation and reduction • To use Mason's gain formula for finding transfer function of a system • To discuss transient and steady state time response of a simple control system. • To discuss the stability of linear time invariant systems and Routh-Hurwitz criterion • To investigate the trajectories of the roots of the characteristic equation when a system parameter is varied. • To conduct the control system analysis in the frequency domain. • To discuss stability analysis using Bode plots. • To determine the controller or compensator configuration and parameter values relative to how it is 			
Module-1			
<p>Introduction to Control Systems: Introduction, classification of control systems.</p> <p>Mathematical models of physical systems: Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, synchros, gear trains. ■</p>			
Module-2			
<p>Block Diagram: Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function.</p> <p>Signal Flow Graphs: Construction of signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, construction of signal flow graph for control systems. ■</p>			
Module-3			
<p>Time Domain Analysis: Standard test signals, time response of first order systems, time response of second order systems, steady state errors and error constants, types of control systems.</p> <p>Routh Stability Criterion: BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems, relative stability analysis. ■</p>			
Module-4			
<p>Root locus Technique: Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.</p> <p>Frequency Response Analysis: Co-relation between time and frequency response – 2nd order systems only.</p> <p>Bode Plots: Basic factors $G(i\omega)/H(j\omega)$, General procedure for constructing bode plots, computation of gain margin and phase margin. ■</p>			
Module-5			
<p>Nyquist plot: Principle of argument, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.</p> <p>Design of Control Systems: Introduction, Design with the PD Controller, Design with the PI Controller, Design with the PID Controller, Design with Phase-Lead Controller, Design with Phase - Lag Controller, Design with Lead-Lag Controller. ■</p>			

Course Outcomes: At the end of the course the student will be able to:

- Analyze and model electrical and mechanical system using analogous.
- Formulate transfer functions using block diagram and signal flow graphs.
- Analyze the stability of control system, ability to determine transient and steady state time response.
- Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots.
- Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Control Systems	Anand Kumar	PHI	2 nd Edition,2014
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Reference Books

1	Automatic Control Systems	Farid Golnaraghi, BenjaminC. Kuo	Wiley	9 Edition,2010
2	Control System Engineering	NormanS. Nise	Wiley	4 Edition,2004
3	Modern Control Systems	Richard C Dorfetal	Pearson	11 Edition,2008
4	Control Systems, Principles and	M. Gopal	McGawHill	4 Edition,2012
5	Control Systems Engineering	S. Salivahananet al	Pearson	1 Edition,2015

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

POWER SYSTEM ANALYSIS – 1 (Core Subject)

Course Code	18EE62	CIE Marks	4
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	6
Credits	04	Exam Hours	0

Course Learning Objectives:

- To introduce the per unit system and explain its advantages and computation.
- To explain the concept of one line diagram and its implementation in problems.
- To explain the necessity and conduction of short circuit analysis.
- To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems.
- To discuss selection of circuit breaker.
- To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits.
- To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits.
- To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines.
- To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components.
- To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine.
- Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system. ■

Module-1

Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of Electrical Power, Representation of Loads. ■

Module-2

Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Illustrative simple examples on power systems. Selection of Circuit Breakers. ■

Module-3

Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System. ■

Module-4

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults. ■

Module-5

Power System Stability: Introduction, Dynamics of a Synchronous Machine, Review of Power Angle Equation, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability, Multi machine stability studies, classical representation. ■

Course Outcomes: At the end of the course the student will be able to:

- Model the power system components & construct per unit impedance diagram of power system.
- Analyze three phase symmetrical faults on power system.
- Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks.
- Analyze various unsymmetrical faults on power system.
- Examine dynamics of synchronous machine and determine the power system stability. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1.	Elements of Power System	William D. Stevenson Jr	McGraw Hill	4 th Edition, 1982
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Reference Books

1	Modern Power System	D. P. Kothari	McGraw Hill	4 th Edition, 2011
2	Power System Analysis and Design	J. Duncan Glover et al	Cengage	4 th Edition, 2008
3	Power System Analysis	Hadi Sadat	McGraw Hill	1 st Edition, 2002

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VI

DIGITAL SIGNAL PROCESSING (Core Subject)

Course Code	18EE63	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	04	Exam Hours	03

Course Learning Objectives:

- To define Discrete Fourier transform and its properties.
- To evaluate DFT of various signals using properties of DFT.
- To explain different linear filtering techniques.
- To explain the evaluation of DFT and inverse DFT using fast and efficient algorithms
- To discuss impulse invariant transformation, bilinear transformation techniques and their properties.
- To design infinite impulse response Butterworth digital filters using impulse invariant and bilinear transformation techniques.
- To design infinite impulse response Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
- To discuss direct, cascade, parallel and ladder methods of realizing a digital IIR filter.
- To discuss window functions used for the design of FIR filters.
- To discuss windowing technique of designing FIR filter.
- To discuss frequency sampling technique of designing FIR filter.
- To discuss direct, cascade and linear phase form of realizing a digital FIR filter. ■

Module-1

Discrete Fourier Transforms: Definitions, properties-linearity, shift, symmetry Properties- circular convolution – periodic convolution, use of tabular arrays, circular arrays, Stock ham’s method, linear convolution – two finite duration sequence, one finite & one infinite duration, overlap add and save methods. ■

Module-2

Fast Fourier Transforms Algorithms: Introduction, decimation in time algorithm, first decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithms, Inverse radix – 2 algorithms. ■

Module-3

Design of IIR Digital Filters: Introduction, impulse invariant transformation, bilinear transformations, All pole analog filters- Butterworth & Chebyshev filters, design of digital Butterworth filter by impulse invariant transformation and bilinear transformation, Frequency transformations. ■

Module-4

Design of IIR Digital Filters (Continued): Design of digital Chebyshev –type 1 filter by impulse invariant transformation and bilinear transformation, Frequency transformations.

Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial. ■

Design of FIR Digital Filters: Introduction, windowing, rectangular, modified rectangular. Hamming, Hanning, Blackman window, design of FIR digital filters by use of windows, Design of FIR digital filters-frequency sampling techniques.

Realization of FIR systems: direct form, cascade form, linear phase form. ■

Course Outcomes: At the end of the course the student will be able to:

- Apply DFT and IDFT to perform linear filtering techniques on given sequences to determine the output.
- Apply fast and efficient algorithms for computing DFT and inverse DFT of a given sequence
- Design and realize infinite impulse response Butterworth and Chebyshev digital filters using impulse invariant and bilinear transformation techniques.
- Develop a digital IIR filter by direct, cascade, parallel, ladder and FIR filter by direct, cascade and linear phase methods of realization.
- Design and realize FIR filters by use of window function and frequency sampling method. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Introduction to Digital Signal Processing	Jhonny R. Jhonson	Pearson	1 st Edition, 2016
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Reference Books

1.	Digital Signal Processing – Principles, Algorithms, and	Jhon G. Proakis Dimitris G. Manolakis	Pearson	4 th Edition, 2007.
2.	Digital Signal Processing	A.NagoorKani	McGraw Hill	2 nd Edition, 2012
3	Digital Signal Processing	Shaila D. Apte	Wiley	2 nd Edition, 2009
4	Digital Signal Processing	Ashok Amberdar	Cengage	1 st Edition, 2007
5	Digital Signal Processing	Tarun Kumar Rawat	Oxford	1 st Edition, 2015

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SEMESTER - VI

INTRODUCTION TO NUCLEAR POWER (PROFESSIONAL ELECTIVE)

Course Code	18EE641	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain the fission process in nuclear materials and how the nuclear reactors work and the basic components of nuclear reactors and their types.
- Explanation about cooling of reactors, features of coolant, different types of coolants used in the reactors and the losses of cooling.
- Discussion on loss of cooling accidents in different reactors.
- Discussion on postulated severe accidents in water cooled reactors and other reactors and cooling of reactor during removal and processing.
- Discussion on cooling and disposing the nuclear waste and prospect of fusion energy in the future. ■

Module-1

The Earth and Nuclear Power: Sources and Resources: Introduction, Earth's Internal Heat Generation, The Earth's Energy Flow, The Fission Process, Thermal Energy Resources.
How Reactors Work: Introduction, The Fission Process, Basic Components of a Nuclear Reactor, Thermal Reactors, Fast Reactors. ■

Module-2

Cooling Reactors: Introduction, General Features of a Reactor Coolant, Principles of Heat Transfer, Gaseous Coolants, Liquid Coolants, Boiling Coolants.
Loss of Cooling: Introduction, The Electric Kettle, Pressurized-Water Reactor, Boiling-Water Reactor, CANDU Reactor, Gas-Cooled Reactors, Sodium- Cooled Fast Reactor. ■

Module-3

Loss-of-Cooling Accidents: Introduction, Incidents in light Water-Cooled Reactors, Heavy Water-Moderated Reactors, Gas-Cooled Reactors, Liquid Metal-Cooled Fast Reactors. ■

Module-4

Postulated Severe Accidents Introduction: Introduction, Postulated Severe Accidents in Water-Cooled Reactors, Specific Phenomena relating to Severe Accidents, Severe Accidents in other Reactor Types, Fission Product Dispersion following Containment Failure.
Cooling during Fuel Removal and Processing: Introduction, Refuelling, Spent Fuel Storage and Transport, Reprocessing Plant. ■

Module-5

Cooling and Disposing of the Waste: Introduction, Classification of Waste Products, Fission Products and Their Biological Significance, Options for Nuclear Waste Disposal, Long-Term Storage and Disposal of Spent Nuclear Fuel, Storage and Disposal of Fission Products from Reprocessing Plants, Disposal of other Materials.
Fusion Energy -Prospect for the Future: Introduction, The Fusion Process, Confinement, Current Technical Position, Conclusions. ■

Course Outcomes:

At the end of the course the student will be able to:

- Explain the fission process in nuclear materials, basic components of nuclear reactors, types of nuclear reactors and their working.
- List different types of coolants, their features, and cooling of reactors,
- Summarize loss of cooling accidents in different reactors.
- Discuss postulated severe accidents in reactors and cooling of reactor during removal of spent fuel.
- Discuss cooling and disposing the nuclear waste and prospect of fusion energy in the future. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Introduction to Nuclear Power	Geoffrey F. Hewitt	Taylor & Francis	1 st Edition, 2000
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Reference Books

1	Nuclear Reactor Engineering	G.Vaidyanathan	S.Chand	1 st Edition, 2013
2	Introduction to Nuclear Engineering	John R Lamarsh Anthony J Baratta	Pearson	3 rd Edition, 2016

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER - VI

ELECTRICAL ENGINEERING MATERIALS (Professional Elective)

Course Code	18EE642	CIE Marks	4
Number of Lecture Hours/Week LTP(L:T:P)	3:0:0	SEE Marks	6
Credits	03	Exam Hours	0

Course Learning Objectives:

- To impart the knowledge of conducting, dielectric, insulating and magnetic materials and their applications.
- To impart the knowledge of superconducting materials and their applications

Module-1

Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.

Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems . ■

Module-2

Conductive Materials and Applications: Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.

Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. ■

Module-3

Insulating Materials: Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.

Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetism and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial and maximum permeability. Hysteresis loop and loss, Eddy current loss. ■

Module-4

Magnetic Materials (continued):Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

Superconductive Materials: Concept of superconductors, Meaning of phenomenon of superconductivity, Properties of superconductors, Types of superconductors, Critical magnetic field

Module-4

Superconductive Materials (continued):and critical temperature, Effects of Isotopic mass on critical temperature, Silsbee rule, Depth of penetration and coherence length. Ideal and Hard superconductors, Mechanism of super conduction, London's theory for Type I superconductors, GLAG theory for Type I superconductors, BCS theory, Applications and limitations. Applications of high temperature superconductors, Superconducting solenoids and magnets, MRI for medical diagnostics. ■

Module-5

Plastics: Introduction, Thermoplastics, Rubbers, Thermosets, DC and AC properties, Mechanical properties and processing of plastic.

Materials for Opto – Electronic Devices: Introduction, Optical phenomena, Reflection, Refraction, Transmittivity, Scattering, Optical absorption, Optical properties of non-metals, Optical properties of metals, Optical properties of semiconductors, Optical properties of insulators. Luminescence, Opto – Electronic devices, Photoconductivity, Photoconductive cell. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss electrical and electronics materials, their importance, classification and operational requirement
- Discuss conducting, dielectric, insulating and magnetic materials used in engineering, their properties and classification.
- Explain the phenomenon superconductivity, super conducting materials and their application in engineering.
- Explain the plastic and its properties and applications

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Advanced Electrical and Electronics Materials; Processes and	K.M. Gupta Nishu Gupta	Wiley	First Edition, 2015
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Reference Books

1	Electronic Engineering Materials	R.K. Shukla Archana Singh	McGraw Hill	2012
2	Electrical Properties of Materials	L Solymar et al	Oxford	9 th Edition, 2014
3	Electrical Engineering Materials	A.J. Dekker	Pearson	2016
4	Principle of Electronic Materials and Devices	S.O. Kasap	McGraw Hill	3 rd Edition 2010

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SEMESTER - VI

COMPUTER AIDED ELECTRICAL DRAWING (PROFESSIONAL

Course Code	18EE643	CIE Marks	40
Number of Lecture Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the terminology of DC and AC armature windings.
- To discuss design and procedure to draw armature winding diagrams for DC and AC machines.
- To discuss the substation equipment, their location in a substation and development of a layout for substation.
- To discuss different sectional views of transformers, DC machine, its parts and alternator and its parts.
- To explain development of sectional views of Transformers, DC machine and alternators using the design data, sketches. ■

Suitable CAD software can be used for drawings

PART - A

Module-1

Winding Diagrams:

- Developed Winding Diagrams of D.C. Machines: Simplex Double Layer Lap and Wave Windings.
- Developed Winding Diagrams of A.C. Machines:
- Integral and Fractional Slot Double Layer Three Phase Lap and Wave Windings.
- Single Layer Windings – Un-Bifurcated 2 and 3 Tier Windings, Mush Windings, Bifurcated 3 Tier Windings. ■

Module-2

Single Line Diagrams: Single Line Diagrams of Generating Stations and Substations Covering Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main), Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power- Line Carrier) and Line Trap. ■

PART - B

Module-3

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:

Transformers - Sectional Views Of Single And Three Phase Core And Shell Type Transformers. ■

Module-4

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:

D.C. Machine - Sectional Views of Yoke with Poles, Armature and Commutator dealt separately. ■

Module-5

Electrical Machine Assembly Drawings Using Design Data, Sketches or Both:

Alternator – Sectional Views of Stator and Rotor dealt separately ■

Course Outcomes: At the end of the course the student will be able to:

- Develop armature winding diagram for DC and AC machines
- Develop a Single Line Diagram of Generating Stations and substation using the standard symbols.
- Construct sectional views of core and shell types transformers using the design data
- Construct sectional views of assembled DC and AC machine and their parts using the design data or the sketches ■

Question paper pattern:

- The question paper will have two parts, PART – A and PART – B.
- Each part is for 50 marks.
- Part A is for Modules 1 and 2.
- Questions 1 and 2 of PART - A will be only on DC windings or only on AC windings. Students have to answer any one of them. The marks prescribed is 25.
- Question 3 of PART – A covering module 2 is compulsory. The marks prescribed is 15.
- Part B is for Modules 3, 4 and 5.
- Questions 4 and 5 will cover any two modules of modules 3, 4 and 5. Students have to answer any one of them. The marks prescribed is 40. ■

Reference Books

1	A course in Electrical Machine design	A. K. Sawhney	DhanpatRai	6 th Edition, 2013
2	Electrical Engineering Drawing	K. L. Narang	Satya Prakashan	2014

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SEMESTER - VI

EMBEDDED SYSTEMS (PROFESSIONAL ELECTIVE)

Course Code	18EE644	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the concepts of Embedded system design such as ROM variants, RAM, SOC
- To learn the technological aspects of Embedded system such as signal conditioning, Sample & Hold.
- To understand the design trade offs.
- To study about the software aspects of Embedded system.

Module-1

Concept of Embedded System Design: Components, classification, skills required. Embedded Micro controller cores: Architecture of 6808 and 6811. Embedded Memories ROM variants, RAM. ■ **T3 and R3**

Module-2

Technological Aspects of Embedded System: Applications of embedded system: Examples of Embedded systems SOC for bar code scanner. Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, Sample & hold, multiplexer interface Internal ADC interfacing (excluding 6805 & 6812). **T1 ■**

Module-3

Design Trade Offs Due to Process Incompatibility, Thermal Considerations: Data Acquisition System and Signal conditioning using DSP . Issues in embedded system design. Design challenge, design technology, trade offs. Thermal considerations. ■

R1 and Internet Sources

Module-4

Software aspects of Embedded Systems: Real time programming Languages, operating systems. Programming concepts and embedded programming in C. Round Robin, Round Robin with interrupts, function queue-scheduling architecture. ■ **T3 and R3**

Module-5

Subsystem interfacing: With external systems user interfacing, Serial I/O devices, Parallel port interfaces: Input switches, Key boards and Memory interfacing. ■ **T1**

Course Outcomes: At the end of the course the student will be able to:

- Identify the Embedded system components.
- Apply technological aspects to various interfacing with devices.
- Elaborate various design tradeoffs.
- Apply software aspects and programming concepts to the design of Embedded System.
- Explain how to interface subsystems with external systems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books:

1	Embedded Microcomputer systems: Real time interfacing	Valvano, J.W	Cengage Learning,	2 nd Edition 5 th Indian
2	The Art of Designing Embedded systems- Ganssle,	Jack, Newness		

3	Embedded System, Architecture, Programming and	Raj Kamal	TMH,	2 nd Edition
Reference Books:				
1	A Unified Hardware/Software Introduction	Frank Vahid/Tony Givargis	Wiley student edition	2002
2	Motorola and Intel Manuals			
3	Embeded Software Premier	Simon David	Addison Wessly	2000

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SEMESTER - VI

OBJECT ORIENTED PROGRAMMING USING C++ (PROFESSIONAL ELECTIVE)

Subject Code	18EE64	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	03	SEE Marks	60
Credits	40	Exam Hours	03

Course Learning Objectives:

This course will enable students to:

- Define Encapsulation, Inheritance and Polymorphism.
- Solve the problem with object oriented approach.
- Analyze the problem statement and build object oriented system model.
- Describe the characters and behavior of the objects that comprise a system.
- Explain function overloading, operator overloading and virtual functions.
- Discuss the advantages of object oriented programming over procedure oriented programming. ■

Module-1

Beginning with C++ and its Features:

What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ ■(Topics from Ch -2,3 of T1).

Module-2

Functions, Classes and Objects:

Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions. ■(Selected Topics from Chap-4,5 of T1).

Module-3

Constructors, Destructors and Operator Overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators. ■ (Selected topics from Chap-6, 7 of T1).

Module-4

Inheritance, Pointers, Virtual Functions, Polymorphism:

Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).

Streams and Working with Files:

C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap- 10, 11 of Text).

Course Outcomes: At the end of the course the student will be able to:

- Explain the basics of Object Oriented Programming concepts.
- Apply the object initialization and destroy concept using constructors and destructors.
- Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
- Utilize the concept of inheritance to reduce the length of code and evaluate the usefulness.
- Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
- Utilize I/O operations and file streams in programs. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books				
1	ObjectOriented Programming with C++	E.Balaguruswamy, TMH	TMH	6th Edition, 2013
Reference Books				
1	ObjectOriented Programming with C++	Robert Lafore	Galgotia publication	2010
2	ObjectOriented Programming with C++	Sourav Sahay	Oxford University	2006

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Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VI

CONTROL SYSTEM LABORATORY

Course Code	18EEL66	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To determine the time and frequency domain responses of a given second order system using software package or discrete components.
- To design and analyze Lead, Lag and Lead – Lag compensators for given specifications.
- To draw the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair.
- To study the DC position & feedback control system and to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- To write a script files to plot root locus, bode plot, to study the stability of the system using a

Sl. NO	Experiments
1	Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor
2	Experiment to draw synchro pair characteristics
3	Experiment to determine frequency response of a second order system
4	(a) To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response.
5	(a) To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response. (b) To determine experimentally the transfer function of the lag compensating network
6	Experiment to draw the frequency response characteristics of the lag – lead compensator network and determination of its transfer function.
7	To study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.
8	(a) To simulate a typical second order system and determine step response and evaluate time response specifications. (b) To evaluate the effect of adding poles and zeros on time response of second order system. (c) To evaluate the effect of pole location on stability
9	(a) To simulate a D.C. Position control system and obtain its step response. (b) To verify the effect of input waveform, loop gain and system type on steady state errors. (c) To perform trade-off study for lead compensator. (d) To design PI controller and study its effect on steady state error.
10	(a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response (b) To study the effect of open loop gain on transient response of closed loop system using root locus.
11	(a) To study the effect of open loop poles and zeros on root locus contour (b) Comparative study of Bode, Nyquist and root locus with respect to stability.

Note:

Sl.	Description	Experiment numbers
1	Perform experiments using suitable components/equipment's	1 & 2
2	Perform experiments using suitable components/equipment's and verify the results using standard simulation package	3,4,5,6 and 7
3	Perform simulation only using standard package	8,9,10 and 11

Course Outcomes: At the end of the course the student will be able to:

- Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
- Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.
- Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.
- Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
- Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based
Education (OBE) SEMESTER -VI**

DIGITAL SIGNAL PROCESSING LABORATORY

Course Code	18EEL67	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To explain the use of MATLAB/Scilab/Python software in evaluating the DFT and IDFT of given sequence
- To verify the convolution property of the DFT
- To design and implementation of IIR and FIR filters for given frequency specifications.
- To realize IIR and FIR filters.
- To help the students in developing software skills. ■

Sl. No	Experiments
1	Verification of Sampling Theorem both in time and frequency domains
2	Evaluation of impulse response of a system
3	To perform linear convolution of given sequences
4	To perform circular convolution of given sequences using (a) the convolution summation formula (b)
5	Computation of N – point DFT and to plot the magnitude and phase spectrum.
6	Linear and circular convolution by DFT and IDFT method.
7	Solution of a given difference equation.
8	Calculation of DFT and IDFT by FFT
9	Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters)
10	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using different window functions
11	Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique.
12	Realization of IIR and FIR filters

Course Outcomes:

At the end of the course the student will be able to:

- Explain physical interpretation of sampling theorem in time and frequency domains.
- Evaluate the impulse response of a system.
- Perform convolution of given sequences to evaluate the response of a system.
- Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods.
- Provide a solution for a given difference equation.
- Design and implement IIR and FIR filters. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

VII SEMESTER DETAILED SYLLABUS

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VII

POWER SYSTEM ANALYSIS – 2(Core Course)

Course Code	18EE71	CIE Marks	40
Number of Lecture Hours/Week	2:2:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain formulation of network models and bus admittance matrix for solving load flow problems.
- To discuss optimal operation of generators on a bus bar and optimum generation scheduling.
- To explain symmetrical fault analysis and algorithm for short circuit studies.
- To explain formulation of bus impedance matrix for the use in short circuit studies on power systems.
- To explain numerical solution of swing equation for multi-machine stability

Module-1

Network Topology: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop analysis. Formation of Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation. Y_{bus} by Inspection Method. Illustrative examples. ■ T1,2

Module-2

Load Flow Studies: Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidal iterative method. Illustrative examples. ■ T1, R1

Module-3

Load Flow Studies(continued) Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LFS methods. Comparison of Load Flow Methods. Illustrative examples. ■ T1, R1

Module-4

Economic Operation of Power System: Introduction and Performance curves Economic generation scheduling neglecting losses and generator limits Economic generation scheduling including generator limits and neglecting losses Economic dispatch including transmission losses Derivation of transmission loss formula. Illustrative examples. T1

Unit Commitment: Introduction, Constraints and unit commitment solution by prior list method and dynamic forward DP approach (Flow chart and Algorithm only). ■ 3

Module-5

Symmetrical Fault Analysis: Z Bus Formulation by Step by step building algorithm without mutual coupling between the elements by addition of link and addition of branch. Illustrative examples. Z bus Algorithm for Short Circuit Studies excluding numerical. T1

Power System Stability: Numerical Solution of Swing Equation by Point by Point method and Runge Kutta Method. Illustrative examples. ■ T1

Course Outcomes: At the end of the course the student will be able to:

- Formulate network matrices and models for solving load flow problems.
- Perform steady state power flow analysis of power systems using numerical iterative techniques.
- Solve issues of economic load dispatch and unit commitment problems.
- Analyze short circuit faults in power system networks using bus impedance matrix.
- Apply Point by Point method and Runge Kutta Method to solve Swing Equation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■
Module 1 Y_{Bus} Matrix size limited to 3X3 for illustrative examples.
Module 2 NR Method limited to 3 bus system with one iteration for illustrative examples.

Text Books

1	Modern Power System Analysis	D P Kothari, I J Nagrath	McGraw Hill	4 th Edition, 2011
2	Computer Methods in Power Systems Analysis	Glenn W. Stagg Ahmed H Ei - Abiad	Scientific International Pvt. Ltd.	1 st Edition, 2019
3	Power Generation Operation and Control	Allen J Wood etal	Wiley	2 nd Edition, 2016

Reference Books

1	Computer Techniques in Power System Analysis	M.A. Pai	McGraw Hill	2 nd Edition, 2012
2	Power System Analysis	Hadi Saadat	McGraw Hill	2nd Edition, 2002

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

POWER SYSTEM PROTECTION (Core Subject)

Course Code	18EE72	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss performance of protective relays, components of protection scheme and relay terminology.
- To explain relay construction and operating principles.
- To explain Over current protection using electromagnetic and static relays and Over current protective schemes.
- To discuss types of electromagnetic and static distance relays, effect of arc resistance, power swings, line length and source impedance on performance of distance relays.
- To discuss pilot protection; wire pilot relaying and carrier pilot relaying.
- To discuss construction, operating principles and performance of various differential relays for differential protection.
- To discuss protection of generators, motors, Transformer and Bus Zone Protection.
- To explain the principle of circuit interruption and different types of circuit breakers.
- To describe the construction and operating principle of different types of fuses and to give the definitions of different terminologies related to a fuse.
- To discuss protection Against Over voltages and Gas Insulated Substation (GIS). ■

Module-1

Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Fault, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.

Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.

Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. ■

Module-2

Overcurrent Protection (continued): Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.

Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays. Effect of Power Surges (Power Swings) on Performance of Distance Relays, Effect of Line Length and Source Impedance on Performance of Distance Relays. ■

Module-3

Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection

Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.

Rotating Machines Protection: Introduction, Protection of Generators.

Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection, Frame Leakage Protection. ■

Module-4

Circuit Breakers: Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF₆ Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers. ■

Module-5

Fuses: Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination.

Protection against Overvoltages: Causes of Overvoltages, Lightning phenomena, Wave Shape of Voltage due to Lightning, Over Voltage due to Lightning, Klydonograph and Magnetic Link, Protection of Transmission Lines against Direct Lightning Strokes, Protection of Stations and Sub – Stations from Direct Strokes, Protection against Travelling Waves, Insulation Coordination, Basic Impulse Insulation Level (BIL).

Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS). ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss performance of protective relays, components of protection scheme and relay terminology over current protection.
- Explain the working of distance relays and the effects of arc resistance, power swings, line length and source impedance on performance of distance relays.
- Discuss pilot protection, construction, operating principles and performance of differential relays and discuss protection of generators, motors, transformer and Bus Zone Protection.
- Explain the construction and operation of different types of circuit breakers.
- Outline features of fuse, causes of overvoltages and its protection, also modern trends in Power System Protection. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Power System Protection and Switchgear	Badri Ram, D.N. Vishwakarma	McGraw Hill	2 nd Edition
2	Power System Protection and Switchgear	Bhuvanesh Oza et al	McGraw Hill	1 st Edition, 2010

Reference Books

1	Protection and Switchgear	Bhavesh et al	Oxford	1 st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1 st Edition, 2009
3	Fundamentals of Power System Protection	Y.G.Paithankar S.R. Bhide	PHI	1 st Edition, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

SOLAR AND WIND ENERGY (Professional Elective)

Course Code	18EE731	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the importance of energy in human life, relationship among economy and environment with energy use.
- To discuss the increasing role of renewable energy, energy management, energy audit, energy efficiency, energy intensity.
- To discuss energy consumption status in India, energy saving potential and energy conservation efforts in India.
- To explain the concept of energy storage and the principles of energy storage devices.
- To discuss the characteristics and distribution of solar radiation, measurement of components of solar radiation and analysis of collected solar radiation data.
- To explain availability of solar radiation at a location and the effect of tilting the surface of collector with respect to horizontal surface.
- To describe the process of harnessing solar energy in the form of heat and working of solar collectors.
- To discuss applications of solar energy including heating and cooling.
- To discuss the operation of solar cell and the environmental effects on electrical characteristics of solar cell
- To discuss sizing and design of typical solar PV systems and their applications.
- To discuss basic Principles of Wind Energy Conversion and to compute the power available in the wind.
- To discuss forces on the Blades, Wind Energy Conversion, collection of Wind Data, energy estimation and site selection.
- To discuss classification of WEC Systems, its advantages and disadvantages of WECS, and Types of Wind Machines (Wind Energy Collectors).
- To evaluate the performance of Wind-machines, Generating Systems. ■

Module-1

Fundamentals of Energy Science and Technology: Introduction, Energy, Economy and Social Development, Classification of Energy Sources, Importance of Non -conventional Energy Sources, Salient features of Non-conventional Energy Sources, World Energy Status, Energy Status in India. **Energy Conservation and Efficiency:** Introduction, Important Terms and Definitions, Important Aspects of Energy Conservation, Global Efforts, Achievements and Future Planning, Energy Conservation/Efficiency Scenario in India, Energy Audit, Energy Conservation Opportunities.

Energy Storage: Introduction, Necessity of Energy Storage, Specifications of Energy Storage Devices. **Solar Energy-Basic Concepts:** Introduction, The Sun as Source of Energy, The Earth, Sun, Earth Radiation Spectrum, Extraterrestrial and Terrestrial Radiations, Spectral Power Distribution of Solar Radiation, Depletion of Solar Radiation. ■

Module-2

Solar Energy-Basic Concepts (continued): Measurement of Solar Radiation, Solar Radiation Data, Solar Time, Solar Radiation Geometry, Solar Day Length, Extraterrestrial Radiation on Horizontal Surface, Empirical Equations for Estimating Terrestrial Solar Radiation on Horizontal Surface, Solar Radiation on Inclined Plane Surface.

Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers. ■

Module-3					
Solar Photovoltaic Systems: Introduction, Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell Technologies, Solar Cell, Module, and Array Construction, Maximizing the Solar PV Output and Load Matching. Maximum Power Point Tracker. Balance of System Components, Solar PV Systems, Solar PV Applications. ■					
Module-4					
Wind Energy: Introduction, Basic Principles of Wind Energy Conversion, History of Wind Energy, Wind Energy Scenario – World and India. The Nature of the Wind, The Power in the Wind, Forces on the Blades, Wind Energy Conversion, Wind Data and Energy Estimation, Site Selection Considerations Wind energy systems: Environment and Economics Environmental benefits and problems of wind energy, Economics of wind energy, Factors influence the cost of energy generation, machine parameters, Life cycle cost analysis ■					
Module-5					
Basic Components of a Wind Energy Conversion(WEC) System: Classification of WEC systems, Advantages and Disadvantages of WECS, Types of Wind Machines (Wind Energy Collectors), Analysis of Aerodynamic Forces Acting on the Blade, Performance of Wind- machines, Generating Systems, Energy Storage, Applications of Wind Energy, Environmental Aspects. ■					
Course Outcomes: At the end of the course the student will be able to:					
<ul style="list-style-type: none"> • Discuss the importance of the role of renewable energy, the concept of energy storage and the principles of energy storage devices. • Discuss the concept of solar radiation data and solar PV system fabrication, operation of solar cell, sizing and design of PV system. • Describe the process of harnessing solar energy and its applications in heating and cooling. • Explain basic Principles of Wind Energy Conversion, collection of wind data, energy estimation and site selection. • Discuss the performance of Wind-machines, energy storage, applications of Wind Energy and environmental aspects. ■ 					
Question paper pattern:					
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 20 marks. • There will be 2 full questions (with a maximum of three sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 					
Textbook					
1	Non-Conventional Energy Resources	B. H. Khan	McGraw Hill	2nd Edition 2017	
2	Non-Conventional Sources of Energy	Rai G. D.	Khanna Publishers	4th Edition, 2009	
Reference Books					
1	Non-Conventional Energy Resources	ShobhNath Singh	Pearson	1st Edition, 2015	
2	Solar Energy – Principles of Thermal Collections and Storage	S.P. Sukhatme J.K.Nayak	McGraw Hill	3rd Edition, 2008	
3	Wind Turbine Technology	Ahmad Hemami	Cengage	1st Edition, 2012	

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

SENSORS AND TRANSDUCERS (Professional Elective)

Course Code	18EE732	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion. To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities. ■

Module-1

Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ■

Module-2

Sensors and Transducers (continued): Strain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ■

Module-3

Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.

Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ■

Module-4

Data Transmission and Telemetry: Data/Signal Transmission, Telemetry.

Measurement of Non – Electrical Quantities: Pressure Measurement. ■

Module-5

Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ■

Course Outcomes: At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3 rd Edition, 2013.
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Reference Books

1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13 th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

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SEMESTER – VII

INTEGRATION OF DISTRIBUTED GENERATION(Professional Elective)

Course Code	18EE733	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain power generation by alternate energy source like wind power and solar power.
- To explain selection of size of units and location for wind and solar systems.
- Discuss the effects of integration of distributed generation on the performance the system.
- To provide practical and useful information about grid integration of distributed generation.

Module-1

Distributed Generation: Introduction, status, Properties of wind power, Power Distribution as a function of wind speed, Solar Power: Status, Properties, Space requirements, Photovoltaic's, Seasonal variation in production capacity, Combined Heat-and-Power: Status, Options for space Heating, Hydropower: Properties of Large Hydro, Properties of small Hydro, Variation with time, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plant. ■

Module-2

Distributed Generation(continued):Interface with the Grid. Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity. Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Active Power Flow Only, Active and Reactive Power Flow Overloading: Redundancy and Meshed Operation Redundancy in Distribution Networks Meshed Operation, Losses. ■

Module-3

Over loading and Losses (continued):Increasing the Hosting Capacity: Increasing the Loadability Building New Connections, Inter trip Schemes, Advanced protection Schemes, Energy Management Systems. Power Electronics approach, Demand Control, Prioritizing Renewable Energy, Dynamic Loadability. Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Marginand Hosting Capacity: Voltage Control in Distribution Systems, Voltage Rise Owing to Distributed Generation, Hosting Capacity, Estimating hosting capacity without Measurements, Sharing hosting capacity. Design of Distribution Feeders: Basic Design Rules, Terminology, An Individual Generator Along a Medium-Voltage Feeder, Low voltage feeders, Series and Shunt Compensation, A Numerical Approach to Voltage Variations: Example for Two-stage Boosting, General Expressions for Two-Stage Boosting Tap Changers with Line- Drop Compensation: Transformer with One Single Feeder, Adding a Generator.ProbabilisticMethodsforDesignofDistributionFeeders:Need for Probabilistic Methods, The System Studied, Generation with Constant Production, Adding Wind Power ■

Module-4

VoltageMagnitudeVariations(continued):StatisticalApproachtoHostingCapacity,IncreasingtheHostin gCapacity: New or Stronger Feeders, Alternative Methods for Voltage Control Accurate Measurement of the Voltage Magnitude Variations, Allowing Higher Overvoltage's Overvoltage Protection, Over Voltage Curtailment Compensating the generators voltage variations, Distributed generation with voltage control, Coordinated voltage control. **Power Quality Disturbances:** Impact of Distributed Generation, Fast Voltage Fluctuations: Fast Fluctuations in Wind Power, Fast Fluctuations in Solar Power, Rapid Voltage Changes, Very Short Variations. Voltage Unbalance :Weaker Transmission System, Stronger Distribution System, Large Single-Phase Generators, Stronger Distribution Grid VoltageUnbalance. ■

Module-5

Power Quality Disturbances(continued): Low-Frequency Harmonics: Wind Power: Induction Generators, Generators with Power Electronics Interfaces, Synchronous Generators, Measurement Example, Harmonic Resonances, Weaker Transmission Grid, Stronger Distribution Grid. High-Frequency Distortion: Emission by Individual Generators, Grouping Below and Above 2 kHz, Limits Below and Above 2 kHz, Voltage Dips: Synchronous Machines Balanced Dips and Unbalanced Dips, Induction generators and unbalanced dips. Increasing the Hosting Capacity: Strengthening the Grid, Emission Limits for Generator Units, Emission Limits for Other Customers, Higher Disturbance Levels, Passive Harmonic Filters, Power Electronics Converters, Reducing the Number of Dips, Broadband and High-Frequency Distortion. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain energy generation by wind power and solar power.
- Discuss the variation in production capacity at different time scales, the size of individual units, and the flexibility in choosing locations with respect to wind and solar systems.
- Explain the performance of the system when distributed generation is integrated to the system.
- Discuss effects of the integration of DG: the increased risk of overload, increased losses, increased risk of overvoltages and increased levels of power quality disturbances.
- Discuss effects of the integration of DG: incorrect operation of the protection.
- Discuss the impact the integration of DG on power system stability and operation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Integration of Distributed Generation in the Power System	Math Bollen	Wiley	2011
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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

ADVANCED CONTROL SYSTEMS (Professional Elective)

Course Code	18EE734	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To introduce state variable approach for linear time invariant systems in both the continuous and discrete time systems
- To explain development of state models for linear continuous – time and discrete – time systems
To explain application of vector and matrix algebra to find the solution of state equations for linear
- continuous – time and discrete – time systems
- To define controllability and observability of a system and testing techniques for controllability and observability of a given system
- To explain design techniques of pole assignment and state observer using state feedback.
- To explain about inherent and intentional nonlinearities that can occur in control system and developing the describing function for the nonlinearities.
- To explain stability analysis of nonlinear systems using describing function analysis.
- To explain the analysis of nonlinear systems using Lyapunov function and design of Lyapunov function for stable systems. ■

Module-1

State Variable Analysis and Design: Introduction, Concept of State, State Variables and State Model, State Models for Linear Continuous–Time Systems, State Variables and Linear Discrete–Time Systems. ■

Module-2

State Variable Analysis and Design (continued): Diagonalization, Solution of State Equations, Concepts of Controllability and Observability. ■

Module-3

Pole Placement Design and State Observers: Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle. ■

Module-4

Non-linear systems Analysis: Introduction, Common Nonlinear System Behaviours, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane. ■

Module-5

Non-linear systems Analysis (continued): Simple Variable Structure Systems, Lyapunov Stability Definitions, Lyapunov Stability Theorems, Lyapunov Functions for Nonlinear Systems ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems.
- Develop of state models for linear continuous–time and discrete–time systems.
- Apply vector and matrix algebra to find the solution of state equations for linear continuous–time and discrete–time systems.
- Define controllability and observability of a system and test for controllability and observability of a given system.
- Design pole assignment and state observer using state feedback.
- Develop the describing function for the nonlinearity present to assess the stability of the system.
- Develop Lyapunov function for the stability analysis of nonlinear systems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Control Systems Engineering (For the Modules1 and 2)	I.J. Nagarathand M.Gopal	NewAge	5 th Edition,2007
2	Digital Control and State Variable Methods: Conventional and Intelligent Control Systems	M.Gopal	McGrawHill	3 rd Edition,2008
3	Modern Control Theory	R. V. Parvatikar	Prism Books Pvt. Ltd.	1 Edition,2014

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

REACTIVE POWER CONTROL IN ELECTRIC POWER SYSTEMS (Professional Elective)

Subject Code	18EE735	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To identify the necessity of reactive power compensation.
- To describe load compensation.
- To select various types of reactive power compensation in transmission systems.
- To characterize distribution side and utility side reactive power management.
- To contrast reactive power coordination system. ■

Module-1

Theory of Load Compensation: Requirement for compensation, Objectives in load compensation, Ideal compensator, Acceptance standards for quality of supply, Specifications of a load compensator, Power factor correction and voltage regulations in single phase system: Power Factor and its Correction, Voltage regulation. T1. Classical load balancing problem: open loop balancing. R1. ■

Module-2

Theory of Steady State Reactive Power in Uncompensated & Compensated Transmission Line : Fundamental requirement in AC power transmission, advantages & disadvantages of different types of compensating equipment for transmission systems, fundamental transmission line equation, surge impedance and natural loading, voltage and current profiles of uncompensated line on open circuit, uncompensated line under load, effect of line length, load power and power factor on voltage and reactive power.

Compensated Transmission Line: Types of compensation, passive and active compensators, Uniformly distributed fixed compensation: Effect of distributed compensation on voltage control and effect of distributed compensation on line charging reactive power. ■T1

Module-3

Basics of Capacitors, Reactive Power of Capacitors, Arrangements and Reactive Power of Capacitors, Capacitors Connected in Parallel: Capacitors Connected in Series, Star and Delta Connection of Power Capacitors, Design of MV Capacitors . T2

Passive shunt compensation: Control of open circuit voltage with shunt reactors, required reactance values of shunt reactors. T1

Series compensation: Objectives and practical limitations, Symmetrical line with mid-point series capacitor and shunt reactor, Power transfer characteristics and maximum transmissible power Fundamental concepts of compensation by sectioning. T■

Module-4

Static Compensation: Practical applications of static compensators in electrical power systems, main types of compensators, principle of operation of Thyristor Controlled Reactor (TCR), Thyristor Controlled Transformer, TCR with shunt capacitors and Thyristor Switched Capacitor (TSC), principle of operation of saturated reactor compensators.

Series Capacitors: compensation factor, protective gear, Varistor protective gear, Resonance effects with series capacitors

Synchronous Condenser: Condenser operation, Power system Voltage control, Emergency reactive power supply, HVDC application.

Comparison of basic types of compensator. T■

Module-5

Harmonics: Effect of harmonics on electrical equipment, resonance, shunt capacitors and filters, telephone interferences.

Reactive Power Co-ordination: Reactive power management, transmission benefits, reactive power dispatch & equipment impact. T1

Reactive Power Planning: Economic justification for reactive power planning, methods followed by the electricity boards in India, zonal reactive power requirements EHV & MV, low tension capacitors, placement in distribution, line capacitors. ■3

Course Outcomes: At the end of the course the student will be able to:

- Distinguish the importance of load compensation in symmetrical as well as unsymmetrical loads.
- Observe various compensation methods in transmission lines.
- Distinguish demand side reactive power management & user side reactive power management.
- Construct model for reactive power coordination and effects of harmonics on electrical equipments.
- Discuss the Reactive Power Planning for the electricity boards. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Reactive power control in electric power systems	T. J. E. Miller	John Wiley & Sons NY	2009
2	Reactive Power Compensation : A Practical Guide	Wolfgang Hofmann, Jorgen Schlabbach, Wolfgang Just.	John Wiley	2012
3	Reactive Power Management	D. Tagare	TMH	1st Edition, 2004

Reference Books

1	Power Quality Enhancement Using Custom Power Devices	Arindam Ghosh, Gerard Ledwich	Kluwer International Series	2002
2	Power System Voltage Stability	Carson. W. Taylor,	McGraw-Hill, Inc.	1993

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

INDUSTRIAL DRIVES AND APPLICATIONS (Professional Elective)

Course Code	18EE741	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To define electric drive, its parts, advantages and explain choice of electric drive.
- To explain dynamics and modes of operation of electric drives.
- To explain selection of motor power ratings and control of DC motor using rectifiers.
- To analyze the performance of induction motor drives under different conditions.
- To explain the control of induction motor, synchronous motor and stepper motor drives.
- To discuss typical applications electrical drives in the industry. ■

Module-1

Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of DC and ac Drives.

Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization.

Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. ■

Module-2

Direct Current Motor Drives: Controlled Rectifier Fed DC Drives, Single Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Single Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Multi-quadrant Operation of DC Separately Excited Motor Fed From Fully Controlled Rectifier, Rectifier Control of DC Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited DC Motor, Chopper Control of Series Motor. ■

Module-3

Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. ■

Module-4

Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors.

Synchronous Motor Drives: Operation from fixed frequency supply-starting, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. ■

Module-5

Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thyristor inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives.

Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor.

Industrial Drives: Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the advantages, choice and control of electric drive
- Explain the dynamics, generating and motoring modes of operation of electric drives
- Explain the selection of motor power rating to suit industry requirements
- Analyze the performance & control of DC motor drives using controlled rectifiers
- Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing	2 nd Edition, 2001
2	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives)	VedumSubrahmanyam	McGraw Hill	2 nd Edition, 2011

Reference Books

1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1 st Edition, 2009
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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

UTILIZATION OF ELECTRICAL POWER(Professional Elective)

Course Code	18EE742	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss electric heating, air-conditioning and electricwelding.
- To explain laws of electrolysis, extraction and refining of metals and electrodeposition.
- To explain the terminology of illumination, laws of illumination, construction and working of electric lamps.
- To explain design of interior and exterior lighting systems- illumination levels for various purposes light fittings- factory lighting- flood lighting-street lighting
- To discuss systems of electric traction, speed time curves and mechanics of train movement.
- To discuss motors used for electric traction and their control.
- To discuss braking of electric motors, traction systems and power supply and other traction systems.
- Give awareness of technology of electric and hybrid electric vehicles. ■

Module-1

Heating and welding: Electric Heating, Resistance ovens, Radiant Heating, Induction Heating, High frequency Eddy Current Heating, Dielectric Heating, The Arc Furnace, Heating of Buildings, Air – Conditioning, Electric Welding, Modern Welding Techniques.

Electrolytic Electro – Metallurgical Process: Ionization, Faraday’s Laws of Electrolysis, Definitions, Extraction of Metals, Refining of Metals, ElectroDeposition. ■

Module-2

Illumination: Introduction, Radiant Energy, Definitions, Laws of Illumination, Polar Curves, Photometry, Measurement of Mean Spherical Candle Power by Integrating Sphere, Illumination Photometer, Energy Radiation and luminous Efficiency, electric Lamps, Cold Cathode Lamp, Lighting Fittings, Illumination for Different Purposes, Requirements of Good Lighting. ■

Module-3

Electric Traction Speed - Time Curves and Mechanics of Train Movement: Introduction, Systems of Traction, Systems of electric Traction, Speed - Time Curves for Train Movement, Mechanics of Train Movement, Train Resistance, Adhesive Weight, Coefficient of Adhesion.

Motors for Electric traction: Introduction, Series and Shunt Motors for Traction Services, Two Similar Motors (Series Type) are used to drive a Motor Car, Tractive Effort and Horse Power, AC Series Motor, Three Phase Induction Motor.

Control of motors: Control of DC Motors, Tapped Field Control or Control by Field Weakening, Multiple Unit Control, Control of Single Phase Motors, Control of Three Phase Motors. ■

Module-4

Braking: Introduction, Regenerative Braking with Three Phase Induction Motors, Braking with Single Phase Series Motors, Mechanical braking, Magnetic Track Brake, Electro – Mechanical Drum Brakes.

Electric Traction Systems and Power Supply: System of Electric Traction, AC Electrification Transmission Lines to Sub - Stations, Sub – Stations, Feeding and Distribution System of AC Traction Feeding and Distribution System for DC Tramways, Electrolysis by Currents through Earth, Negative Booster, System of Current Collection, Trolley Wires.

Trams, Trolley Buses and Diesel – Electric Traction: Tramways, The Trolley – Bus, Diesel Electric Traction. ■

Module-5

Electric Vehicles: Configurations of Electric Vehicles, Performance of Electric Vehicles, Tractive Effort in Normal Driving, Energy Consumption.

Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss different methods of electric heating & welding.
- Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process.
- Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems.
- Analyze systems of electric traction, speed time curves and mechanics of train movement.
- Explain the motors used for electric traction, their control & braking and power supply system used for electric traction. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	A Text Book on Power System Engineering	A. Chakrabarti et al	Dhanpat Rai and Co	2 nd Edition, 2010
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Theory, and Design (Chapters 04 and 05 for module 5)	Mehrdad Ehsani et al	CRC Press	1 st Edition, 2005

Reference Books

1	Utilization, Generation and Conservation of Electrical Energy	Sunil S Rao	Khanna Publishers	1 st Edition, 2011
2	Utilization of Electric Power and Electric Traction	G.C. Garg	Khanna Publishers	9 th Edition, 2014

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

PLC and SCADA(Professional Elective)

Course Code	18EE743	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3L	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-in Circuits and Latching Relays.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes.
- To understand SCADA and how it deals with the control and data acquisition from systems
- To understand what RTU does, how it does and what. ■

Module-1

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of operation ■

Module-2

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. ■

Module-3

Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■

Module-4

SCADA Fundamentals: Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs), Data concentrators and merging units, SCADA communication systems,

Master Station: Master station software components, Master station hardware components, Server systems in the master station, Small, medium, and large master stations, Global positioning systems (GPS), Master station performance. ■

Module-5

Human-Machine Interface (HMI):HMI components, HMI software functionalities, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements,

SCADA Systems: Building the SCADA systems, legacy, hybrid, and new systems, Classification of SCADA systems, SCADA implementation: A laboratory model: The SCADA laboratory, System hardware, System software, SCADA lab field design. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss history of PLC, its sequence of operation, advantages and disadvantages, main parts and their functions.
- Describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
- Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
- Convert relay schematics and narrative descriptions into PLC ladder logic programs.
- Analyse PLC timer and counter ladder logic programs.
- Understand about SCADA systems and its subsystems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill	4 th Edition, 2011
2	Power System SCADA and Smart Grids	Mini S. Thomas	CRC Press	3 rd Edition, 2015

Reference Book

1	Programmable Logic Controllers an Engineer's Guide	E A Parr	Newnes	3rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3rd Edition, 2006

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

SMART GRID (Professional Elective)

Course Code	18EE744	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3L	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand the basic concept of smart grid, attributes of Smart Grid
- To describe the over view of the perfect power system configuration
- To know about DC power delivering systems ,data centers and information technology loads
- To educate the importance of Technology Alternatives in smart Grid
- To understand the Dynamic energy systems in Smart Grid
- To describe the overview of Demand side planning and evaluation

Module-1

Introduction: Introduction to smart grid, electricity network, local energy networks, electric transportation, low carbon central generation, attributes of the smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction, overview of the perfect power system configurations, device level power system, building integrated power systems, distributed power systems, fully integrated power system. ■

Module-2

DC Distribution and Smart Grid: AC Vs. DC sources, benefits of and drives of DC power delivery systems, powering equipment and appliances with DC, data centers and information technology loads, potential future work and research

Intelligrid Architecture for the Smart Grid: Introduction, launching intelligrid, intelligrid today, smart grid vision based on the intelligrid architecture. ■

Module-3

Dynamic Energy Systems Concept: Smart energy efficient end use devices, smart distributed energy resources, advanced whole building control systems, integrated communications architecture, energy management, role of technology in demand response, current limitations to dynamic energy management, distributed energy resources, overview of a dynamic energy management, key characteristics of smart devices, key characteristics of advanced whole building control systems, key characteristics of dynamic energy management system. ■

Module-4

Efficient Electric End Use Technology Alternatives: Existing technologies ,lighting, space conditioning, indoor air quality, domestic water heating, hyper efficient appliances, ductless residential heat pumps and air conditioners, variable refrigerant flow air conditioning, heat pump water heating, hyper efficient residential appliances, data center energy efficiency, LED street and area lighting, industrial motors and drives, equipment retrofit and replacement, process heating, cogeneration, thermal energy storage, industrial energy management programs, manufacturing process, electro -technologies, residential, commercial and industrial sectors. ■

Module-5

Demand side planning: Introduction, Selecting Alternatives, Issues Critical to the Demand-side Issues Critical to the Demand-side, The Utility Planning Process, Demand-side Activities, Alternatives that Are Most Beneficial.

Demand-Side Evaluation: Levels of Analysis. General Information Requirements .System, Context, Transferability, Data Requirement, Cost/Benefit Analysis, Program Interaction. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the concept of Smart grid enables the ElectricNet and need of smart grid.
- Outline the benefits and drivers of DC Power delivery system.
- Summarize the Intelligrid Architecture for the smart grid.
- Explain the Efficient Electric End-use Technology Alternatives.
- Discuss Demand side planning and Evaluation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.

Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	The Smart Grid, Enabling Energy Efficiency and Demand Side Response	Clark W Gellings	CRC Press, 2009.	3 rd Edition, 2013.
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Reference Books

1	Smart Grid :Technology and Applications	Janaka Ekanayake, Kithsiri Liyanage,Jianzhong	Wiley	2012
2	Fundamentals of Design and Analysis	James Momoh	Wiley, IEEE Press,	2012

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

ARTIFICIAL NEURAL NETWORK WITH APPLICATIONS TO POWER SYSTEMS
(Professional Elective)

Subject Code	18EE745	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	4	Exam Hours	03

Course Learning Objectives:

- To understand the fundamental concepts and models of Artificial Neural Systems.
- To understand neural processing, learning and adaptation, Neural Network learning rules.
- Ability to analyze multilayer feed forward networks.
- Ability to develop various ancillary techniques applied to power system and control of power systems.

Module-1

Fundamental Concepts and Models of Artificial Neural Systems

Biological Neurons and their artificial models – Biological Neuron, McCulloch-Pitts Neuron Model, Neuron modeling for Artificial neural systems. Models for Artificial Neural Networks – Feedforward Network, Feedback network. ■

Module-2

Neural Processing, Learning and Adaptation, Neural Network Learning Rules

Neural Processing. Learning and Adaptation – Learning as Approximation or Equilibria Encoding, Supervised and Unsupervised Learning. Neural Network Learning Rules – Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule, Outstar Learning Rule, Summary of Learning Rules. ■

Module-3

Multilayer Feedforward Networks

Feedforward Recall and Error Back-Propagation Training – Feedforward Recall, Error Back-Propagation Training, Training Errors and Multilayer Feedforward Networks as Universal Approximators (Excluding Examples). Learning Factors – Initial Weights, Cumulative Weight Adjustment versus Incremental Updating, Steepness of the Activation Function, Learning Constant, Momentum Method, Network Architectures Versus Data Representation, Necessary Number of Hidden Neurons. ■

Module-4

Neural Network and its Ancillary Techniques as Applied to Power Systems

Introduction, Learning versus Memorization, Determining the Best Net Size, Network Saturation, Feature Extraction, Inversion of Neural Networks, Alternative Training Method: Genetic Based Neural Network, Fuzzified Neural Network. ■

Module – 5

Control of Power Systems

Introduction, Background, Neural Network Architectures for modeling and control, Supervised Neural Network Structures, Diagonal Recurrent Neural Network based Control System, Convergence and Stability. ■

Course Outcomes: At the end of the course the student will be able to:

- Develop Neural Network and apply elementary information processing tasks that neural network can solve.
- Develop Neural Network and apply powerful, useful learning techniques.
- Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm.
- Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available.
- Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Introduction to Artificial Neural Systems.	Jacek M. Zurada	JAICO Publishing House	2006
2	Artificial Neural Networks with Applications to Power Systems	Edited by – Mohamed El – Sharkawi and Dagmar Niebur	IEEE, Inc.	1996

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

POWER SYSTEM SIMULATION LABORATORY

Course Code	18EEL76	CIE Marks	40
Number of Practical Hours/Week(L:T:P)	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

To explain the use of standard software package:

(Ex: MATLAB/C or C ++/Scilab/ Octave/Python software)

- To assess the performance of medium and long transmission lines.
- To obtain the power angle characteristics of salient and non- salient pole alternator.
- To study transient stability of radial power systems under three phase fault conditions.
- To develop admittance and impedance matrices of interconnected power systems.
- To explain the use of suitable standard software package.
- To solve power flow problem for simple power systems.
- To perform fault studies for simple radial power systems.
- To study optimal generation scheduling problems for thermal power plants. ■

Sl. No.	Experiments
1	Formation for symmetric π /T configuration for Verification of Determination of Efficiency and Regulation.
2	Determination of Power Angle Diagrams, Reluctance Power, Excitation, EMF and Regulation for Salient and Non-Salient Pole Synchronous Machines.
3	To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.
4	Y Bus Formation for Power Systems with and without Mutual Coupling, by Singular
5	Formation of Z Bus(without mutual coupling) using Z-Bus Building Algorithm.
6	Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage
7	Formation of Jacobian for a System not Exceeding 4 Buses in Polar Coordinates.
8	Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses.
9	To Determine Fault Currents and Voltages in a Single Transmission Line System with
10	Optimal Generation Scheduling for Thermal power plants by simulation.

Use of Standard Simulation Software Package

Course Outcomes: At the end of the course the student will be able to:

- Develop a program in suitable package to assess the performance of medium and long transmission lines.
- Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator.
- Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems.
- Develop programs in suitable package to formulate bus admittance and bus impedance matrices of interconnected power systems.
- Use suitable package to solve power flow problem for simple power systems.
- Use suitable package to study unsymmetrical faults at different locations in radial power systems
- Use of suitable package to study optimal generation scheduling problems for thermal power plants. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII

RELAY AND HIGH VOLTAGE LABORATORY

Course Code	18EEL77	CIE Marks	40
Number of Practical Hours/Week	0:2:2	SEE Marks	60
Credits	02	Exam Hours	03

Course Learning Objectives:

- To conduct experiments to verify the characteristics of over current, over voltage, under voltage relays both electromagnetic and static type.
- To verify the operation of negative sequence relay.
- To conduct experiments to verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
- To conduct experiments on generator, motor and feeder protection.
- To conduct experiments to study the spark over characteristics for both uniform and non-uniform configurations using High AC and DC voltages.
- To measure high AC and DC voltages
- To experimentally measure the breakdown strength of transformer oil.
- To experimentally measure the capacitance of different electrode configuration models using Electrolytic Tank. To generate standard lightning impulse voltage and determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■

Sl. NO	Experiments
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Total of Six experiments are to be conducted by selecting Two experiments from each Part – A, Part – B and Part – C. Five out of six experiments are to be conducted under Part – D.

1	Part - A	Over Current Relay: (a)Inverse Definite Minimum Time(IDMT)Non-Directional Characteristics (b) Directional Features (c) IDMT Directional.
2		IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).
3		Operation of Negative Sequence Relay.
4	Part - B	Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.
5		Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.
6		Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage
7	Part - C	Generation Protection: Merz Price Scheme.
8		Feeder Protection against Faults.
9		Motor Protection against Faults.
10	Part - D	Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1) : 1993] Configurations: Sphere – Sphere, Point –Plane,
11		Spark Over Characteristics of Air subjected to High voltage DC.
12		Measurement of HVAC and HVDC using Standard Spheres as per IS 1876 :2005
13		Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005
14		Field Mapping using Electrolytic Tank for any one of the following Models: Cable/ Capacitor/
15		(a) Generation of standard lightning impulse voltage and to determine efficiency and energy of impulse generator. (b) To determine 50% probability flashover voltage for air insulation subjected to impulse voltage.

Course Outcomes: At the end of the course the student will be able to:

- Verify the characteristics of over current, over voltage, under voltage and negative sequence relay both electromagnetic and static type.
- Verify the characteristics of microprocessor based over current, over voltage, under voltage relays and distance relay.
- Show knowledge of protecting generator, motor and feeders.
- Analyze the spark over characteristics for both uniform and non-uniform configurations using High A and DC voltages.
- Measure high AC and DC voltages and breakdown strength of transformer oil.
- Draw electric field and measure the capacitance of different electrode configuration models.
- Show knowledge of generating standard lightning impulse voltage to determine efficiency, energy of impulse generator and 50% probability flashover voltage for air insulation. ■

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. ■

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
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SEMESTER – VII

PROJECT PHASE – I

Course Code	18EEP78	CIE Marks	100
Number of Practical Hours/Week	0:0:2	Exam Hours	--
Credits	1	Exam Marks	--

Course Learning Objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organization, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgment, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work

Course Outcomes: At the end of the course the student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.
- Design engineering solutions to complex problems utilizing a systems approach.
- Communicate with engineers and the community at large in written and oral forms.

Continuous Internal Evaluation

CIE marks for the project phase I 100 marks.

- i. Report 50 marks
- ii. Partial result and presentation 50 marks

Marks shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairman.

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VIII			
POWER SYSTEM OPERATION AND CONTROL(Core Course)			
Course Code	18EE81	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • To describe various levels of controls in power systems and the vulnerability of the system. • To explain components, architecture and configuration of SCADA. • To explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control • To explain automatic generation control, voltage and reactive power control in an interconnected power system. • To explain reliability and contingency analysis, state estimation and related issues. ■ 			
Module-1			
<p>Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centers. R1</p> <p>Supervisory Control and Data acquisition (SCADA): Introduction, components, application in Power System, basic functions and advantages. Building blocks of SCADA system, components of RTU, communication subsystem, IED functional block diagram. R2</p> <p>Classification of SCADA system: Single master–single remote; Single master–multiple RTU; Multiple master–multiple RTUs; and Single master, multiple submaster, multiple remote. R2</p>			
Module-2			
<p>Automatic Generation Control (AGC): Introduction, Schematic diagram of load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case), Turbine speed governing system, Model of speed governing system, Turbine model, Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control area concept, Proportional plus Integral Controller. T1</p>			
Module-3			
<p>Automatic Generation Control in Interconnected Power system: Two area load frequency control, Optimal (Two area) load frequency control by state variable, Automatic voltage control, Load frequency control with generation rate constraints (GRCs), Speed governor dead band and its effect on AGC, Digital LF Controllers, Decentralized control. T1</p>			
Module-4			
<p>Control of Voltage and Reactive Power: Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power, Shunt capacitors and reactors, Series capacitors, Synchronous compensators, Series injection. ii Tap changing transformers. Combined use of tap changing transformers and reactive power injection, Booster transformers, Phase shift transformers, Voltage collapse. T3</p>			

Module-5

Power System Security: Introduction, Factors affecting power system security, Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, Contingency Selection and Ranking. T2

State estimation of Power Systems: Introduction, Linear Least Square Estimation. T2

Course Outcomes: At the end of the course the student will be able to:

- Describe various levels of controls in power systems, architecture and configuration of SCADA.
- Develop and analyze mathematical models of Automatic Load Frequency Control.
- Develop mathematical model of Automatic Generation Control in Interconnected Power system
- Discuss the Control of Voltage , Reactive Power and Voltage collapse.
- Explain security, contingency analysis, state estimation of power systems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Modern Power System Analysis	D. P. Kothari	McGraw Hill	4 th Edition, 2011
2	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition,2003
3	Electric Power Systems	B M Weedy, B J	Wiley	4 th Edition, 2012

Reference Books

1	Computer-Aided Power System Analysis	G. L. Kusic	CRC Press	2nd Edition.2010
2	Power System SCADA and Smart Grid	Mini S Thom and John D. McDonald	CRC Press	2015
3	Power System Stability and Control	Kundur	McGraw Hill	8 th Reprint, 2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

FACTS AND HVDC TRANSMISSION (Professional Elective)

Course Code	18EE821	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	3	Exam Hours	03

Course Learning Objectives:

- To discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
- To explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
- To describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
- To describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
- To explain advantages of HVDC power transmission, overview and organization of HVDC system.
- To describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
- Explain converter control for HVDC systems, commutation failure, control functions. ■

Module-1

FACTS Concept and General System Considerations: Transmission Interconnections, Flow of Power in an AC System, What Limits the Loading Capability? Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers, Checklist of Possible Benefits from FACTS Technology, In Perspective: HVDC or FACTS. ■

Module-2

Static Shunt Compensators: Objectives of Shunt Compensation - Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability. Methods of Controllable Var Generation –Thyristor controlled Reactor (TCR) and Thyristor Switched Reactor (TSR), Thyristor Switched Capacitor (TSC). Operation of Single Phase TSC – TSR. Switching Converter Type Var Generators, Basic Operating Principles, Basic Control Approaches. Static VAR Compensators: SVC and STATCOM, the Regulation Slope. Comparison between STATCOM and SVC, $V - I$ and $V - Q$ Characteristics, Transient stability, Response Time. ■

Module-3

Static Series Compensators: Objectives of Series Compensation, Concept of Series Capacitive Compensation, Voltage Stability, Improvement of Transient Stability. GTO Thyristor-Controlled Series Capacitor, Thyristor-Switched Series Capacitor, Thyristor-Controlled Series Capacitor, The Static synchronous Series Compensator, Transmitted Power Versus Transmission Angle Characteristic. ■

Module-4

Development of HVDC Technology: Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, HVDC Characteristics and Economic Aspects.

Power Conversion: 3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter. ■

Module-5

Control of HVDC Converter and System: Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design, HVDC Control Functions, Reactive Power and Voltage Stability. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters.
- Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology.
- Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability.
- Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current.
- Explain advantages of HVDC power transmission, overview and organization of HVDC system.
- Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter.
- Explain converter control for HVDC systems, commutation failure, control

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems	Narain G Hingorani, Laszlo Gyugyi	Wiley	1 st Edition, 2000
2	HVDC Transmission: Power Conversion Applications in Power Systems	Chan-Ki Kim et al	Wiley	1 st Edition, 2009

Reference Books

1	Thyristor Based FACTS Controllers for Electrical Transmission Systems	R. Mohan Mathur, Rajiv K. Varma	Wiley	1 st Edition, 2002
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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

ELECTRICAL ESTIMATION AND COSTING (Professional Elective)

Course Code	18EE822	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss the purpose of estimation and costing.
- To discuss market survey, estimates, purchase enquiries, tenders, comparative statement and payment of bills and Indian electricity act and some of the rules.
- To discuss distribution of energy in a building, wiring and methods of wiring, cables used in internal wiring, wiring accessories, fittings and fuses.
- To discuss design of lighting points and its number, total load, sub-circuits, size of conductor.
- To discuss different types of service mains and estimation of power circuits.
- To discuss estimation of overhead transmission and distribution system and its components.
- To discuss main components of a substation, their graphical representation and preparation of single line diagram of a substation. ■

Module-1

Principles of Estimation: Introduction to Estimation and Costing, Electrical Schedule, Catalogues, Market Survey and Source Selection, Recording of Estimates, Determination of Required Quantity of Material, Labour Conditions, Determination of Cost Material and Labour, Contingencies, Overhead Charges, Profit, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Comparative Statement, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79. ■

Module-2

Wiring: Introduction, Distribution of energy in a Building, PVC Casing and Capping, Conduit Wiring, Desirabilities of Wiring. Types of cables used in Internal Wiring, Multi Strand Cables, Voltage Grading and Specification of Cables

Wiring (continued): Main Switch and Distribution Board, Conduits and its accessories and Fittings Lighting Accessories and Fittings, Types of Fuses, Size of Fuse, Fuse Units, Earthing Conductor

Internal Wiring: General rules for wiring, Design of Lighting Points (Refer to Seventh Chapter of the Text Book), Number of Points, Determination of Total Load, Number of Sub –Circuits, Ratings Main Switch and Distribution Board and Size of Conductor. Current Density, Layout. ■

Module-3

Service Mains: Introduction, Types, Estimation of Underground and Overhead Service Connections.

Design and Estimation of Power Circuits: Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Size of Condit, Distribution Board Main Switch and Starter. ■

Module-4

Estimation of Overhead Transmission and Distribution Lines: (Review of Line Supports, Conductor Materials, Size of Conductor for Overhead Transmission Line, Types of Insulators)[No Question Shall be Set From the Review Portion].

Cross Arms, Pole Brackets and Clamps, Guys and Stays, Conductors Configuration Spacing and Clearances, Span Lengths, Lightning Arrestors, Phase Plates, Danger Plates, Anti Climbing Devices, Bird Guards, Beads of Jumpers, Muffs, Points to be Considered at the Time of Erection of Overhead Lines, Erection of Supports, Setting of Stays, Fixing of Cross Arms, Fixing of Insulators, Conductor Erection. ■

Module-4 (continued)

Estimation of Overhead Transmission and Distribution Lines (continued): Repairing and Jointing of Conductors, Dead End Clamps, Positioning of Conductors and Attachment to Insulators, Jumpers, Tee-Offs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor From Ground, Spacing Between Conductors, Important Specifications. ■

Module-5

Estimation of Substations: Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, Single Line Diagram of Typical Substations, Equipment for Substation, Substation Auxiliaries Supply, Substation Earthing. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain general principles of estimation and major applicable I.E. rules.
- Discuss wiring methods, cables used, design of lighting points and sub-circuits, internal wiring, wiring accessories and fittings, fuses and types.
- Discuss estimation of service mains and power circuits.
- Discuss estimation of overhead transmission and distribution system its components.
- Discuss types of substation, main components and estimation of substation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	A Course in Electrical Installation Estimating and Costing	J. B. Gupta	Katson Books,	9 th Edition, 2012
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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

ELECTRIC VEHICLE TECHNOLOGIES (Professional Elective)

Subject Code	18EE823	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles.
- Ability to design converters for battery charging and explain transformer less topology.

Module-1

Electric and Hybrid Electric Vehicles

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

Module-2

Energy storage for EV and HEV

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

Module-3

Electric Propulsion

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

Module – 4

Design of Electric and Hybrid Electric Vehicles

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

Module – 5

Power Electronic Converter for Battery Charging

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z- converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the working of electric vehicles and recent trends.
- Analyze different power converter topology used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles.
- Design converters for battery charging and explain transformer less topology. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S. Gay and Ali Emadi	CRC Press	2005
2	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	2003

Reference Books

1	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Sheldon S. Williamson	Springer	2013
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	OXFORD University	2001
3	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Wiley Publication	2011

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)**

POWER SYSTEM PLANNING (Professional Elective)

Subject Code	18EE824	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss primary components of power system planning namely load forecasting, evaluation of energy resources, provisions of electricity Act and Energy Conservation Act.
- To explain planning methodology for optimum power system expansion, various types of generation, transmission and distribution
- To explain forecasting of anticipated future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.
- To discuss methods to mobilize resources to meet the investment requirement for the power sector
- To perform economic appraisal to allocate the resources efficiently and take proper investment decisions
- To discuss expansion of power generation and planning for system energy in the country
- To discuss evaluation of operating states of transmission system, their associated contingencies and determination of the stability of the system for worst case conditions
- To discuss principles of distribution planning, supply rules, network development and the system studies
- To discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis.
- To discuss grid reliability, voltage disturbances and their remedies.
- To discuss planning and implementation of electric –utility activities designed to influence consumer uses of electricity.
- To discuss market principles and the norms framed by CERC for online trading and exchange in the interstate power market. ■

Module-1

Power System: Planning Principles, Planning Process, Project Planning, Power Development, National and Regional Planning, Enterprise Resources Planning, Planning Tools, Power Planning Organisation, Scenario Planning.

Electricity Forecasting: Load Requirement, System Load, Electricity Forecasting, Forecasting Techniques, Forecasting Modelling, Spatial – Load Forecasting, Peak Load - Forecast, Reactive – Load Forecast, Unloading of a System. ■

Module-2

Power-System Economics: Financial Planning, Techno – Economic Viability, Private Participation, Financial Analysis, Economic Analysis, Transmission, Rural Electrification Investment, Total System Analysis, Credit - Risk Assessment.

Generation Expansion: Generation Capacity and Energy, Generation Mix, Clean Coal Technologies Renovation and Modernisation of Power Plants. ■

Module-3

Transmission Planning: Transmission Planning Criteria, Right – of – Way, Network Studies, High – Voltage Transmission, HVDC Transmission, Conductors, Sub – Stations, Power Grid, Reactive Power Planning, Energy Storage. ■

Module-4

Distribution: Distribution Deregulation, Planning Principles, Electricity – Supply Rules, Criteria and Standards, Sub – Transmission, Basic Network, Low Voltage Direct Current Electricity,

Module-4 (continued)

Distribution(continued): Upgradation of Existing Lines and Sub – Stations, Network Development, System Studies, Urban Distribution, Rural Electrification.

Reliability and Quality: Reliability Models, System Reliability, Reliability and Quality Planning, Functional Zones, Generation Reliability Planning Criteria, Transmission Reliability Criteria, Distribution Reliability, Reliability Evaluation, Grid Reliability, Quality of Supply. ■

Module-5

Demand-Side Planning: Demand Response, Demand – Response Programmes, Demand– Response Technologies, Energy Efficiency, Energy - Economical Products, Efficient – Energy Users, Supply – Side Efficiency, Energy Audit.

Electricity Market: Market Principles, Power Pool, Independent System Operator, Distribution System Operator, Power Markets, Market Rules, Bidding, Trading, Settlement System, Merchant Power, Differential Electricity, Congestion Management, Ancillary Services, Hedging, Smart Power Market. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting.
- Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions
- Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system.
- Discuss principles of distribution planning, supply rules, network development and the system studies
- Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies
- Discuss planning and implementation of electric –utility activities, market principles and the norms framed. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook

1	Electric Power Planning	A. S. Pabla	McGraw Hill,	2 nd Edition,
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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VIII

ELECTRICAL POWER QUALITY (Professional Elective)

Course Code	18EE825	CIE Marks	40
Number of Lecture Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Review definitions and standards of common power quality phenomena.
- Understand power quality monitoring and classification techniques.
- Investigate different power quality phenomena causes and effects.
- Understand different techniques for power quality problems mitigation.
- Understand the various power quality phenomenon, their origin and monitoring and mitigation methods.
- Understand the effects of various power quality phenomenon in various equipment's

Module-1

Introduction: Power quality-voltage quality, power quality evaluation procedures term and definitions: general classes of power quality problems, transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion, power quality terms. ■

Module-2

Voltage sags and interruptions: Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection, motor starting sags.

Transient over voltages: Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients. ■

Module-3

Transient over voltages: Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion, intra harmonics. ■

Module-4

Applied harmonics: Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics. ■

POWER QUALITY BENCHMARK: Introduction, benchmark process, power quality contract.

Module-5

Power quality benchmark: power quality state estimation, including power quality in distribution planning.

Distributed generation and quality: DG technologies, interface to utility system, power quality issues, interconnection standards. ■

Course Outcome: At the end of the course the student will be able to:

- Define Power quality; evaluate power quality procedures and standards.
- Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages.
- Identify various sources of harmonics, explain effects of harmonic distortion.
- Evaluate harmonic distortion, control harmonic distortion.
- Estimate power quality in distribution planning. Identify power quality issues in utility system. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1.	Electric Power Quality	Dugan, Roger C, Mark F	McGraw-Hill professional	2003.
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Reference Books

1.	Electric Power Quality	G.T.Heydt	Stars in a circle publications	1991.
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2.	Understanding power quality problems voltage sags and interruptions	Math H. J. Bollen.	IEEE Press	2000
3.	Power quality in power systems and electrical machines	Ewald F Fuchs, Mohammad, A.S., Masoum	Academic Press, Elsevier	2009

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – VII / VIII

INTERNSHIP

Course Code	18EEI85	CIE Marks	40
Number of Practical Hours/Week	--	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

Internship provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public. ■

Internship: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

Course Outcomes: At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills. ■

Continuous Internal Evaluation

CIE marks : 40 Marks

- i. Successful completion of Internship training in an organization and certification from competitive authority-20 marks
- ii. Presentation and report -20 Marks

(based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department.

The committee shall consist

of three faculty from the department with the senior most acting as the Chairman. ■

Semester End Examination

SEE marks – 60 Marks based on presentation skill, participation in the question and answer session by the student to the examiners appointed by the University. ■

Open Electives A/B

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – VI			
INDUSTRIAL SERVO CONTROL SYSTEMS(Open Elective)			
Course Code	18EE651	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Course Learning Objectives: <ul style="list-style-type: none"> • To explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques. • To discuss system analogs and vectors, with a review of differential equations. • To discuss the concept of transfer functions for the representation of differential equations. • To discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors. • To represent servo drive components by their transfer function, to combine the servo drive building blocks into system block diagrams. • To determine the frequency response techniques for proper servo compensation. ■ 			
Module-1			
Servos: Introduction, Benefits of Servo Systems, Types of Servos - Evolution of Servo Drives, Classification of Drives, Components of Servos - Hydraulic/Electric Circuit Equations, Actuators—Electric, Actuators—Hydraulic, Amplifiers—Electric, Amplifiers—Hydraulic, Transducers (Feedback). ■			
Module-2			
Machine Servo Drives: Types of Drives, Feed Drive Performance. Troubleshooting Techniques: Techniques by Drive, Problems: Their Causes and Cures. Machine Feed Drives: Advances in Technology, Parameters for making Application Choices. Application of Industrial Servo Drives: Introduction ,Physical System Analogs, Quantities and Vectors, Differential Equations for Physical Systems, Electric Servo Motor Transfer Functions and Time Constants, Transport Lag Transfer Function, Hydraulic Servo Motor Characteristics, General Transfer Characteristics. ■			
Module-3			
Generalized Control Theory: Servo Block Diagrams, Frequency-Response Characteristics and Construction of Approximate (Bode) Frequency Charts, Nichols Charts, Servo Analysis Techniques, Servo Compensation. Indexes of Performance: Definition of Indexes of Performance for Servo Drives, Indexes of Performance for Electric and Hydraulic Drives. ■			
Module-4			
Performance Criteria: Percent Regulation, Servo System Responses. Ser Plant Compensation Techniques: Dead-Zone Nonlinearity, Change-in-Gain Nonlinearity Structural Resonances, Frequency Selective Feedback, Feed forward Control. Machine Considerations: Machine feed drive Considerations, Ball Screw Mechanical Resonances and Reflected Inertias for Machine Drives. ■			
Module-5			
Machine Considerations: Drive Stiffness, Drive Resolution, Drive Acceleration, Drive Speed Considerations, Drive Ratio Considerations, Drive Thrust/Torque And Friction Considerations, Drive Duty Cycles. ■			

Course Outcomes: At the end of the course the student will be able to:

- Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques.
- Discuss system analogs, vectors and transfer functions of differential equations.
- Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors.
- Represent servo drive components by their transfer function, to combine the servo drive buildingblocks into system block diagrams.
- Determine the frequency response techniques for proper servo compensation.
- Explain perform indices and performance criteria for servo systems and discuss the mechanical considerations of servosystems. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Industrial Servo Control Systems Fundamentals and Applications	George W. Younkin	Marcel Dekker	1 st Edition, 2003
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Reference Books

1	Servo Motors and Industrial Control Theory	Riazollah Firoozian	Springer	2 nd Edition, 2014
2	DC SERVOS Application and Design with MATLAB	Stephen M. Tobin	CRC	1 st Edition, 2011

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B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI

PLC and SCADA (Open Elective)

Course Code	18EE652	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning

Objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
- To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays.
- To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions.
- To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
- To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction.
- To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions.
- To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations.
- To describe the operation of bit and word shift registers and develop programs that use shift registers.
- To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes. ■

Module-1

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation ■

Module-2

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. ■

Module-3				
<p>Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.</p> <p>Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction. ■</p>				
Module-4				
<p>Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.</p> <p>Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations. ■</p>				
Module-5				
<p>Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.</p> <p>Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA). ■</p>				
<p>Course Outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming. • Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module. • Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions • Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system. • Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. ■ 				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 20 marks. • There will be 2 full questions (with a maximum of three sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbook				
1	Programmable Logic Controllers	Frank D Petruzella	McGraw Hill,	4th Edition, 2011
Reference Book				
1	Programmable Logic Controllers an Engineer's Guide	E A Parr	Newnes	3rd Edition, 2013
2	Introduction Programmable Logic Controllers	Gary Dunning	Cengage	3rd Edition, 2006

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI

RENEWABLE ENERGY RESOURCES(Open Elective)

Course Code	18EE653	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- To explain sun – earth geometric relationship, Earth – Sun Angles and their Relationships
- To discuss about solar energy reaching the Earth’s surface and solar thermal energy applications.
- To discuss types of solar collectors, their configurations and their applications
- To explain the components of a solar cell system, equivalent circuit of a solar cell, its characteristics and applications.
- To discuss benefits of hydrogen energy, production of hydrogen energy, storage its advantages and disadvantages.
- To discuss wind turbines, wind resources, site selection for wind turbine
- To discuss geothermal systems, their classification and geothermal based electric power generation
- To discuss waste recovery management systems, advantages and disadvantages
- To discuss biomass production, types of biomass gasifiers, properties of producer gas.
- To discuss biogas, its composition, production, benefits.
- To discuss tidal energy resources, energy availability, power generation.
- To explain motion in the sea wave, power associated with sea wave and energy availability and the devices
- for harnessing wave energy.

Module-1

Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.

Energy from Sun: Sun- earth Geometric Relationship, Layer of the Sun, Earth – Sun Angles and their Relationships, Solar Energy Reaching the Earth’s Surface, Solar Thermal Energy Applications. ■

Module-2

Solar Thermal Energy Collectors: Types of Solar Collectors, Configurations of Certain Practical Solar Thermal Collectors, Material Aspects of Solar Collectors, Concentrating Collectors, Parabolic Dish – Stirling Engine System, Working of Stirling or Brayton Heat Engine, Solar Collector Systems into Building Services, Solar Water Heating Systems, Passive Solar Water Heating Systems, Applications of Solar Water Heating Systems, Active Solar Space Cooling, Solar Air Heating, Solar Dryers, Crop Drying, Space Cooling, Solar Cookers, Solar pond.

Solar Cells: Components of Solar Cell System, Elements of Silicon Solar Cell, Solar Cell materials, Practical Solar Cells, I – V Characteristics of Solar Cells, Efficiency of Solar Cells, Photovoltaic

Module-3

Hydrogen Energy: Benefits of Hydrogen Energy, Hydrogen Production Technologies, Hydrogen Energy Storage, Use of Hydrogen Energy, Advantages and Disadvantages of Hydrogen Energy, Problems Associated with Hydrogen Energy.

Wind Energy: Windmills, Wind Turbines, Wind Resources, Wind Turbine Site Selection.

Geothermal Energy: Geothermal Systems, Classifications, Geothermal Resource Utilization, Resource Exploration, Geothermal Based Electric Power Generation, Associated Problems, environmental Effects. **Solid waste and Agricultural Refuse:** Waste is Wealth, Key Issues, Waste Recovery Management Scheme, Advantages and Disadvantages of Waste Recycling, Sources and Types of Waste, Recycling of Plastics. ■

Module-4

Biomass Energy: Biomass Production, Energy Plantation, Biomass Gasification, Theory of Gasification, Gasifier and Their Classifications, Chemistry of Reaction Process in Gasification, Updraft, Downdraft and Cross-draft Gasifiers, Fluidized Bed Gasification, Use of Biomass Gasifier, Gasifier Biomass Feed Characteristics, Applications of Biomass Gasifier, Cooling and Cleaning of Gasifiers.

Biogas Energy: Introduction, Biogas and its Composition, Anaerobic Digestion, Biogas Production, Benefits of Biogas, Factors Affecting the Selection of a Particular Model of a Biogas Plant, Biogas Plant Feeds and their Characteristics.

Tidal Energy: Introduction, Tidal Energy Resource, Tidal Energy Availability, Tidal Power Generation in India, Leading Country in Tidal Power Plant Installation, Energy Availability in Tides, Tidal Power Basin, Turbines for Tidal Power, Advantages and Disadvantages of Tidal Power, Problems Faced in Exploiting Tidal Energy. ■

Module-5

Sea Wave Energy: Introduction, Motion in the sea Waves, Power Associated with Sea Waves, Wave Energy Availability, Devices for Harnessing Wave Energy, Advantages and Disadvantages of Wave Power.

Ocean Thermal Energy: Introduction, Principles of Ocean Thermal Energy Conversion (OTEC), Ocean Thermal Energy Conversion plants, Basic Rankine Cycle and its Working, Closed Cycle, Open Cycle and Hybrid Cycle, Carnot Cycle, Application of OTEC in Addition to Produce Electricity, Advantages, Disadvantages and Benefits of OTEC. ■

Course Outcomes: At the end of the course the student will be able to:

- Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy.
- Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications.
- Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications.
- Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse.
- Discuss production of energy from biomass, biogas.
- Summarize tidal energy resources, sea wave energy and ocean thermal energy. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook				
1	Nonconventional Energy Resources	ShobhNath Singh	Pearson	1st Edition, 2015
Reference Books				
1	Nonconventional Energy Resources	B.H. Khan	McGraw Hill	3rd Edition,
2	Renewable Energy; Power for a sustainable Future	Godfrey Boyle	Oxford	3rd Edition, 2012
3	Renewable Energy Sources: Their Impact on global Warming and Pollution	TasneemAbbasi S.A. Abbasi	PHI	1st Edition, 2011

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VI

TESTING AND COMMISSIONING OF POWER SYSTEM APPARATUS (Open Elective)

Course Code	18EE654	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Identification of tools and equipment's used for installation and maintenance of electrical equipment.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, insulators and switchgears.

Module-1

Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safety Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices.

Transformers: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions. ■

Module-2

Synchronous Machines: Specifications as per BIS Standards. Installation - Physical Inspection, Foundation Details, Alignments, Excitation Systems, Cooling and Control Gear, Drying Out. Commissioning Tests - Insulation, Resistance Measurement of Armature and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance. ■

Module-3

Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Test. ■

Module-4

Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handling Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights. ■

Module-5

Switchgear and Protective Devices: Standards, Types, Specification, Installation, Commissioning Tests, Maintenance Schedule, Type and Routine Tests.

Domestic Installation: Introduction, Testing of Electrical Installation of a Building, Testing of Insulation Resistance to Earth, Testing of Insulation and Resistance between Conductors Continuity or Open Circuit Test, Short Circuit Test, Testing of Earthing Continuity, Location of Faults, IE Rules for Domestic Installation. ■

Course Outcomes: At the end of the course the student will be able to:

- Describe the process to plan, control and implement commissioning of electrical equipment's.
- Differentiate the performance specifications of transformer and induction motor.
- Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
- Describe corrective and preventive maintenance of electrical equipment's.
- Explain the operation of an electrical equipment's such as isolators, circuit breakers, induction motor and synchronous machines. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text/ Reference Books

1	Testing, Commissioning, Operation and	S. Rao	Khanna Publishers	6 th Edition, 19 th Reprint, 2015
2	Testing and Commissioning of Electrical	R.L.Chakrasali	Prism Books Pvt Ltd	1 st Edition, 2014
3	Preventive Maintenance of Electrical Apparatus	S.K.Sharotri	Katson Publishing House	1 st Edition, 1980
4	Handbook of Switchgears	BHEL	McGraw Hill	1 st Edition, 2005
5	Transformers	BHEL	McGraw Hill	1 st Edition, 2003
6	The J&P Transformer Book	Martin J. Heathcote	Newnes	12 th Edition, 1998

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VII

INDUSTRIAL MOTORS & CONTROL (Open Elective)

Course Code	18EE751	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide basic principles and types of electrical motors.
- To study DC motors, performance, control and applications and Selection of the motors for a particular application.
- To study types Starting and Breaking of Motors
- To study different types of Speed Control of Motors
- To study Selection of Motors for Industrial Drives & Economic Selection of Electric Motors
- To impart the knowledge of Electrical Drawings, Installation, Maintenance & Safety of Electrical Installation. ■

Module-1

Types of Motors DC Motor: Motor Principle, Back emf, Equivalent Circuit of DC Motor Armature, Torque, Types, Characteristics of Shunt Series and Compound Motors.

3 phase Induction Motor: Principle of operation, Speed and Slip, Frequency of Rotor Voltage and Current, Torque of an Induction Motor, Maximum Torque, Torque Slip and Torque Slip Characteristics.

Single Phase Induction Motors: Production of Rotating Field, Single Phase Induction Motor Principle, Types of Single Phase Induction Motors. ■

Module-2

Starting and Breaking of Motors:

DC Motor: Necessity of Starter, Three Point and Four Point Starter, Representation of on four quadrant diagram, Electric breaking of DC motor, Regenerative Breaking and Plugging or Reverse Current Breaking.

Induction Motor: Starting of Gauge Motors – DOL, Star Delta, Auto Transformers Starters, Slip Ring Induction Motors Starters, Regenerative braking of induction motor, Plugging Braking of induction motor. ■

Module-3

Speed Control of Motors:

DC Motor: Rheostatic Control, Field Flux Control, Armature Voltage Control (Ward –Leonard Method) and Solid State Control (Block Diagram Approach Only).

Induction Motor: Pole Changing Method, Stator Voltage Control, Rotor Resistance Control, Slip Energy Recovery. ■

Module-4

Selection of Motors for Industrial Drives and Applications:

Selection of Motors: Introduction, Power Range for Motors and Drives, Load Requirements – Torque–Speed Characteristics, General Application Considerations. Economic Selection of Electric Motors.

Motor Applications: Motors for Textile, Machine Tool, Cranes, Compressors, Water Supply, Coal Mining and Rolling Mills applications. ■

Module-5

Electrical Installation for Motors: Introduction, Motor Terminal Connections, Motor Nameplate Details, Important Consideration Regarding Motor Installation Wiring, Determination of Input Power and Current, Determination of Rating of Cables. Determination of Rating of Fuses, Determination of Size of Conduit, Distribution Board, Main Switch and Starter, Problems on Estimation of material required of Motor Installation.

Maintenance and Safety: Motor Maintenance, Troubleshooting Motors, Protection of motor for specific conditions, maintenance of motors, Motor faults and causes. Contactor Ratings: NEMA Ratings, IEC Ratings, Protecting against Electrical Shock, Grounding and Bonding, Lockout and Tagout, Electrical Codes and Standards. ■

Course Outcomes: At the end of the course, the student will be able to

- Basic principles of electric motors explain the procedure of selecting rating of the motor for any application.
- Classify DC motors, explain the torque speed characteristics and select a motor for an application.
- Classify Induction Motors, explain the torque speed characteristics and select a motor for an application.
- Explain the types of Starting and Breaking of Motors
- Explain the different types of Speed Control of Motors
- Selection of Motors for Industrial Drives & Economic Selection of Electric Motors.
- Discuss Electrical Drawings, Installation, Maintenance & Safety ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electric Machines	Ashfaq Husain	Dhanpat Rai & Co	2013
2	Electric Motor Drives, Fundamentals, Types and Applications	Austin Hughes	Elsevier ,Third edition	2006
3	Electrical motors applications and control.	M V Deshapande	PHI publications	2010
4	Electric Motors and Control Systems- Career Education	Frank Petruzella	McGraw-Hill Companies, Inc.	2010
5	A Course in Electrical Installation Estimating & Costing	J, B, Gupta	S. K. Kataria & Sons 9 th Edition	2012

. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER –VII

SENSORS AND TRANSDUCERS (Open Elective)

Course Code	18EE752	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To discuss need of transducers, their classification, advantages and disadvantages.
- To discuss working of different types of transducers and sensors.
- To discuss recent trends in sensor technology and their selection.
- To discuss basics of signal conditioning and signal conditioning equipment.
- To discuss configuration of Data Acquisition System and data conversion.
- To discuss the basics of Data transmission and telemetry.
- To explain measurement of various non-electrical quantities. ■

Module-1

Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers. ■

Module-2

Sensors and Transducers (continued): Strain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Selection of Sensors, Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers, Micro Electromechanical Systems. ■

Module-3

Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers.

Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. ■

Module-4

Data Transmission and Telemetry: Data/Signal Transmission, Telemetry.

Measurement of Non – Electrical Quantities: Pressure Measurement

Module-5

Measurement of Non – Electrical Quantities (continued): Temperature Measurement, Flow Measurement – Introduction, Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power, Measurement of Liquid Level, Measurement of Viscosity. ■

Course Outcomes: At the end of the course the student will be able to:

- Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages.
- Explain the working of various transducers and sensors.
- Outline the recent trends in sensor technology and their selection.
- Analyze the signal conditioning and signal conditioning equipment.
- Illustrate different configuration of Data Acquisition System and data conversion.
- Show knowledge of data transmission and telemetry.
- Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electrical and Electronic Measurements and instrumentation	R.K Rajput	S. Chand	3 rd Edition, 2013.
Reference Books				
1	A Course in Electronics and Electrical Measurements and Instruments	J.B. Gupta	Katson Books	13 th Edition, 2008
2	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawheny	DhanpatRai	2015

**. E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based
Education (OBE) SEMESTER –VII**

ELECTRIC VEHICLES (Open Elective)

Subject Code	18EE753	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To Understand the fundamental laws and vehicle mechanics.
- To Understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles.

Module-1

Vehicle Mechanics

Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design. ■

Module-2

Electric and Hybrid Electric Vehicles

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. ■

Module-3

Energy storage for EV and HEV

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors. ■

Module-4

Electric Propulsion

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. ■

Module – 5

Design of Electric and Hybrid Electric Vehicles

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design. ■

Course Outcomes: At the end of the course the student will be able to:

- Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
- Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
- Model batteries, Fuel cells, PEMFC and super capacitors.
- Analyze DC and AC drive topologies used for electric vehicle application.
- Develop the electric propulsion unit and its control for application of electric vehicles. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S. Gay and Ali Emadi	CRC Press	2005
2	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	2003

Reference Books

1	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Sheldon S. Williamson	Springer	2013
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	OXFORD University	2001
3	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Wiley Publication	2011

B . E. ELECTRICAL AND ELECTRONICS ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based
Education (OBE) SEMESTER –VII

ELECTRICAL ENERGY CONSERVATION AND AUDITING (Open Elective)

Subject Code	18EE754	CIE Marks	40
Number of Lecture Hours/Week	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- Understand the current energy scenario and importance of energy conservation.
- Understand the methods of improving energy efficiency in different electrical systems.
- Realize energy auditing.
- Explain about various pillars of electricity market design.
- To explain the scope of demand side management, its concept and implementation issues and strategies.

Module-1

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features. ■

Module-2

Energy Efficiency in Electrical Systems: Electricity billing, Electrical load management and maximum demand Control, Maximum demand controllers; Power factor improvement, Automatic power factor controllers, efficient operation of transformers, energy efficient motors, Soft starters, Variable speed drives; Performance evaluation of fans and pumps, Flow control strategies and energy conservation opportunities in fans and pumps, Electronic ballast, Energy efficient lighting and measures of energy efficiency in lighting system. ■

Module-3

Energy auditing: Introduction, Elements of energy audits, different types of audit, energy use profiles measurements in energy audits, presentation of energy audit results. ■

Module-4

Electricity vis-à-vis Other Commodities: Distinguishing features of electricity as a commodity, Four pillars of market design: Imbalance, Scheduling and Dispatch, Congestion Management, Ancillary Services. Framework of Indian power sector and introduction to the availability based tariff (ABT). ■

Module-5

Energy Audit Applied to Buildings: Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings. Demand side Management: Scope of DSM, Evolution of DSM concept, DSM planning and Implementation, Load management as a DSM strategy, Applications of Load Control, End use energy conservation, Tariff options for DSM. ■

Course Outcomes: At the end of the course the student will be able to:

- Analyze about energy scenario nationwide and worldwide , also outline Energy Conservation Act and its features.
- Discuss load management techniques and energy efficiency.
- Understand the need of energy audit and energy audit methodology.
- Understand various pillars of electricity market design.
- Conduct energy audit of electrical systems and buildings.
- Show an understanding of demand side management and energy conservation. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Books

1	Energy Management Handbook	W.C. Turner	Publisher John Wiley and Sons
2	Energy Efficient Electric Motors and Applications	H.E. Jordan	Plenum Pub. Corp
3	Energy Management Author Publisher	W. R. Murphy, G. Mckay	Butterworths

Reference Books

1	Energy Science Principles, Technologies and Impact,	J. Andrews, N. Jelley	Oxford University Press.
2	Market operations in power systems: Forecasting, Scheduling, and Risk Management,	Shahedepour M., Yamin H., Zuyi Li.	John Wiley & Sons, New York
3	Energy Conservation	Diwan, P.	Pentagon Press (2008)

**SCHEME OF TEACHING & EXAMINATION
BE CIVIL ENGINEERING
SEMESTER**

III

Sl. No	Subject Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Th.	Pr.	Duration	I.A. Max. Marks	Theory/ Pract. Max. Marks	Total Marks Max. Marks
1	10 MAT 31	Engineering Mathematics –III	Maths	4	--	3	25	100	125
2	10 CV 32	Building Materials and Construction Technology	Civil	4	--	3	25	100	125
3	10 CV 33	Strength of Materials	Civil	4	--	3	25	100	125
4	10 CV 34	Surveying – I	Civil	4	--	3	25	100	125
5	10 CV 35	Fluid Mechanics	Civil	4	--	3	25	100	125
6	10 CV 36	Applied Engineering Geology	Civil/Geo.	4	--	3	25	100	125
7	10 CVL 37	Civil Engg. Material Testing Laboratory	Civil	---	3	3	25	50	75
8	10 CVL 38	Surveying Practice – I	Civil	---	3	3	25	50	75
			Total	22	08	24	200	700	900

**SCHEME OF TEACHING & EXAMINATION
BE CIVIL ENGINEERING
SEMESTER**

IV

S. No	Subject Code	Title	Teaching Dept.	Teaching hours /week		Examination			
				Th.	Pr.	Duration	I.A. Max. Marks	Theory/ Pract. Max. Marks	Total Marks Max. Marks
1	10 MAT 41	Engineering Mathematics –IV	Maths	4	--	3	25	100	125
2	10 CV 42	Concrete Technology	Civil	4	--	3	25	100	125
3	10 CV 43	Structural Analysis – I	Civil	4	--	3	25	100	125
4	10 CV 44	Surveying – II	Civil	4	--	3	25	100	125
5	10 CV 45	Hydraulics and Hydraulic Machines	Civil	4	--	3	25	100	125
6	10 CV 46	Building Planning & Drawing	Civil	1	6	4	25	100	125
7	10 CVL 47	Surveying Practice-II Laboratory	Civil	---	3	3	25	50	75
8	10 CVL 48	Applied Engineering Geology Laboratory	Civil/Geo.	---	3	3	25	50	75
			Total	21	12	25	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. CIVIL ENGINEERING
V SEMESTER**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10 AL 51	Management & Entrepreneurship	Any Dept.	04	-	03	25	100	125
2	10 CV 52	Design of RCC Structural Elements	Civil	04	--	03	25	100	125
3	10 CV 53	Structural Analysis – II	Civil	04	--	03	25	100	125
4	10 CV 54	Geotechnical Engineering. – I	Civil	04	--	03	25	100	125
5	10 CV 55	Hydrology and Irrigation Engineering	Civil	04	--	03	25	100	125
6	10 CV 56	Transportation Engineering – I	Civil	04	--	03	25	100	125
7	10 CVL 57	Hydraulics and Hydraulic Machinery Lab.	Civil	--	03	03	25	50	75
8	10 CVL 58	Computer Aided Design Lab.	Civil	--	03	03	25	50	75
TOTAL				24	06	24	200	700	900

**SCHEME OF TEACHING AND EXAMINATION
B.E. CIVIL ENGINEERING
VI SEMESTER**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	10 CV 61	Environmental Engineering - I	Civil	04	--	03	25	100	125
2	10 CV 62	Design & Drawing of RC structures	Civil	02	03	04	25	100	125
3	10 CV 63	Transportation Engineering – II	Civil	04	--	03	25	100	125
4	10 CV 64	Geotechnical Engineering. – II	Civil	04	--	03	25	100	125
5	10 CV 65	Hydraulic Structures and Irrigation Design-Drawing	Civil	02	03	04	25	100	125
6	10 CV 66x	Elective-I (Group A)	Civil	04	--	03	25	100	125
7	10 CVL 67	Geotechnical Engineering. Lab.	Civil	--	03	03	25	50	75
8	10 CVL 68	Extensive Survey Viva Voce	Civil	--	03	03	25	50	75
TOTAL				20	12	25	200	700	900

Elective-I (Group A)

10 CV 663 Ground Improvement Techniques

10 CV 666 Rural Water Supply and Sanitation

**SCHEME OF TEACHING AND EXAMINATION
B.E. CIVIL ENGINEERING
VII SEMESTER**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Duration (Hrs)	Examination		
				Theory	Practical		IA	Marks	
								Theory / Practical	Total
1	10 CV 71	Environmental Engineering.-II	Civil	04	--	03	25	100	125
2	10 CV 72	Design of Steel Structures	Civil	04	--	03	25	100	125
3	10 CV 73	Estimation and Valuation	Civil	04	--	03	25	100	125
4	10 CV 74	Design of Pre Stressed Concrete Structures	Civil	04	--	03	25	100	125
5	10 CV 75x	Elective-II (Group B)	Civil	04	--	03	25	100	125
6	10 CV 76x	Elective-III (Group C)	Civil	04	--	03	25	100	125
7	10 CVL 77	Environmental Engineering. Lab	Civil	--	03	03	25	50	75
8	10 CVL 78	Concrete and Highway Materials lab.	Civil	--	03	03	25	50	75
TOTAL				24	06	24	200	700	900

Elective-II (Group B)

10 CV 757 Solid Waste Management

Elective-III (Group C)

10 CV 763 Pavement Materials and Construction

**SCHEME OF TEACHING AND EXAMINATION
B.E. CIVIL ENGINEERING
VIII SEMESTER**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Duration (Hrs)	Examination		
				Theory	Practical		IA	Marks	
								Theory / Practical	Total
1	10 CV 81	Advanced Concrete Technology	Civil	04	--	03	25	100	125
2	10 CV 82	Design and Drawing of Steel Structures	Civil	02	03	04	25	100	125
3	10 CV 83x	Elective-IV (Group D)	Civil	04	--	03	25	100	125
4	10 CV 84x	Elective-V (Group E)	Civil	04	--	03	25	100	125
5	10 CV 85	Project Work	Civil	--	06	03	100	100	200
6	10 CV 86	Seminar	Civil	--	03	03	50	--	50
TOTAL				14	12	19	250	500	750

Elective-IV (Group D)

10 CV 832 Advanced Foundation Design

Elective-V (Group E)

10 CV 842 Reinforced Earth Structures

ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31
Hrs/Week: 04
Total Hrs: 52

IA Marks: 25
Exam Hrs: 03
Exam Marks:100

PART-A

Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples*

Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. [7 hours]

Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms [6 hours]

Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation. [6 hours]

Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form $y = ax+b$, $y = a x^2 + b x + c$, $y = ae^{bx}$, $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method. [7 hours]

PART-B

Unit-V: NUMERICAL METHODS - 1

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

Unit-VI: NUMERICAL METHODS – 2

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

Unit-VII: NUMERICAL METHODS – 3

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations

[7 hours]

Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

Note: * In the case of illustrative examples, questions are not to be set.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd. Publishers

ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41

Hrs/Week: 04

Total Hrs: 52

IA Marks: 25

Exam Hrs: 03

Exam Marks:100

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order. Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions. Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, empirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

Unit-VII: PROBABILITY THEORY - 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

Unit-VIII: SAMPLING THEORY

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

ENGINEERING MATHEMATICS – III

Sub Code	10MAT31	IA Marks	25
Hrs/ Week	04	Exam Hours	03
Total Hrs.	52	Exam Marks	100

BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY (COMMON TO CV/TR/CTM)

Sub Code	: 10 CV 32	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

Part-A

UNIT-1

FOUNDATION

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations, Design of strip and combined footings 6 hours

UNIT-2

MASONRY

Classification of Masonry, Definition of terms used in Masonry, Introduction to classification and qualities of bricks, Bonds in Brick work - English Bond, Flemish Bond, Reinforced, Brick Masonry, Common building stones, their properties and uses, Classification of stone masonry, Joints in stone masonry, Introduction to load bearing, cavity and partition walls. 8 hours

UNIT-3

ARCHES, LINTEL AND BALCONY

Elements of an arch, Classification of arches, Stability of arch, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony. 6 hours

UNIT-4

ROOFS AND FLOORS

Types of Roofs & Roofing materials, Flat roof (RCC), Types of pitched roofs, Wooden Truss, Steel trusses, Types of flooring, Factors affecting selection of flooring materials. 7 hours

Part-B

UNIT-5

DOORS AND WINDOWS

Location of doors and windows, Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows & their properties. 6 hours

UNIT-6

STAIRS

Definition of technical terms, Requirements of ground stair, Types of Stairs, Geometrical design of RCC Dog legged and open well stairs (Plain and sector elevation). 6 hours

UNIT-7

PLASTERING AND PAINTING

Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering, Introduction to Paintings and types of Painting, Constituents of paints & types, Purpose of Painting, Defects in Painting, Application of Paints to new and old surfaces. 6 hours

UNIT-8

MISCELLANEOUS TOPICS

Properties and uses of plastics, aluminum, glasses, varnishes, Introduction to smart materials and its application, Introduction to formwork and scaffolding, Formwork details for RCC Column, Beams and Floors, Shoring and under pinning, Damp Proofing - Causes of Dampness, Effects of Dampness, Methods of Damp Proofing 7 hours

TEXT BOOKS

1. **Engineering Materials**, Rangawala P.C. Charter Publishing House, Anand, India.
2. **Engineering Materials**, Sushil Kumar, Standard Publication and Distributors, New Delhi.
3. **Concrete technology – Theory and practice**, M..S. Shetty, S. Chand and Co, New Delhi, 2002.

REFERENCE BOOKS

1. **A Text Book Building Materials**, by P.G. Varghese, Prentice-Hall of India Pvt. Ltd., Publication.
2. **Advances in Building Materials and Construction** by Mohan Rai and M.P. Jain Singh – publication by CBRI, Roorkee.
3. **Concrete Technology**, Neville A.M and Brooks J.J — ELBS Edition. London
4. **Concrete Technology** – Gambhir M.L –Dhanpat Rai and Sons, New Delhi.

STRENGTH OF MATERIALS
(COMMON TO CV/TR/EV/CTM)

Sub Code	:	10 CV 33	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

Simple Stress and Strain

Introduction, 1.2 Properties of Materials, 1.3 Stress, Strain, Hook's law, Stress – Strain Diagram for structural steel and non ferrous materials, 1.4 Volumetric strain, expression for volumetric strain, 1.5 Elastic Constants: Relationship among elastic constants, 1.6 Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self weight.

7 Hours

UNIT 2:

Simple Stress and Strain *continued...*

2.1 Composite section, 2.3 Thermal stresses (including thermal stresses in compound bars).

6 Hours

UNIT 3:

Compound stresses

3.1 Introduction, 3.2 Stress components on inclined planes, 3.3 General two-dimensional stress system, 3.4 Principal planes and stresses, 3.5 Mohr's circle of stresses.

8 Hours

UNIT 4:

Bending moment and shear force in beams

4.1 Introduction, 4.2 Shearing force and Bending moment in beam, 4.3 Sign convention, 4.4 Relationship between loading, shear force and bending moment, 4.5 Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering gravity loads (point, udl and uvl) and Couple.

7 Hours

PART – B

UNIT 5:

Bending stress, shear stress in beams

5.1 Introduction – Bending stress in beam, 5.2 Assumptions in pure bending theory, 5.3 Derivation of Pure bending equation, 5.4 Modulus of rupture, section modulus, 5.5 Flexural rigidity, 5.6 Expression for horizontal shear

stress in beam, 5.7 Shear stress diagram for rectangular, „I“ and „T“ section (Flitched beams not included).

6 Hours

UNIT 6:

Deflection of beams

6.1 Introduction – Definitions of slope, deflection, 6.2 Elastic curve-derivation of differential equation of flexure, 6.3 Sign convention 6.4 Slope and deflection for standard loading classes using Macaulay’s method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.

6 Hours

UNIT 7:

Torsion of circular shafts

7.1 Introduction – Pure torsion-torsion equation of circular shafts, 7.2 Strength and stiffness, 7.3 Torsional rigidity and polar modulus, 7.4 Power transmitted by shaft of solid and hollow circular sections.

6 Hours

UNIT 8:

Elastic stability of columns

8.1 Introduction – Short and long columns, 8.2 Euler’s theory on columns, 8.3 Effective length slenderness ratio, 8.4 Radius of gyration, buckling load, 8.5 Assumptions, derivations of Euler’s Buckling load for different end conditions, 8.6 Limitations of Euler’s theory, 8.7 Rankine’s formula, problems.

6 Hours

TEXT BOOKS:

1. **Strength of Materials**, Subramanyam, Oxford University Press, Edition 2008
2. **Mechanics of Materials**, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.
3. **Strength of Materials**, Basavarajaiah and Mahadevappa Universities Press (2009).

REFERENCE BOOKS:

1. **Strength of Materials**, Singer Harper and Row Publications.
2. **Elements of Strength of Materials**, Timoshenko and Young Affiliated East-West Press.
3. **Mechanics of Materials**, James M. Gere, Barry J. Goodno (India Edition), Cengage Learning.

SURVEYING – I
(COMMON TO CV/TRE/CTM)

Sub Code	:	10 CV 34	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

Introduction

1.1 Definition of Surveying, 1.2 Classification of Surveys, 1.3 Uses of Surveying Units of Measurements, 1.4 Map & Classification, 1.5 Survey of India topographical Maps and their numbering., 1.6 Basic principles of surveying, 1.7 Errors, Classification, 1.8 Precision and accuracy.

04 Hours

UNIT 2:

Measurement of horizontal distances.

2.1 Chain and types, 2.2 Tape and types, 2.3 EDM devices, 2.3 Ranging of lines 2.4 Direct and Indirect, 2.5 Measurement of distances over sloping grounds, 2.6 Chain and Tape corrections - Numerical problems.

5 Hours

UNIT 3:

Chain Surveying

3.1 Accessories required, 3.2 Selection of stations and lines, 3.3 Offsets and types 3.4 Setting out of right angles, 3.5 Working principle and use of optical square, prism square, cross staff., 3.6 Linear methods of setting out right angles, 3.7 Booking of chain survey work, 3.8 Field book, entries, conventional symbols, 3.9 Obstacles in chain survey, Numerical problems, 3.10 Errors in chain survey and precautions to be taken.

7 Hours

UNIT 4:

Compass Surveying

4.1 Meridians and bearings, 4.2 Principle, working and use of - Prismatic compass 4.3 Surveyor's compass, 4.4 Magnetic bearing, true bearings, 4.5 WCB and Reduced bearing. 4.6 Dip and Declination 4.7 Accessories required for compass surveying, 4.8 Traverse - closed and open traverse 4.9 Computation of bearings of legs of closed traverse given the bearing of one of the legs, 4.10 Computation of included angles given the

bearings of legs of a closed traverse.

6 Hours

PART – B

UNIT 5:

Compass Traversing *continued....*

5.1 Local attraction, determination and corrections, 5.2 Dependent and independent co-ordinates, 5.3 Checks for closed traverse and determination of closing error and its direction 5.4 Bowditch's graphical method of adjustment of closed traverse, 5.5 Bowditch's rule and transit rule, 5.6 Omitted measurements (Only Length and corresponding bearing of one line).

8 Hours

UNIT 6:

Introduction to Levelling

6.1 Principles and basic definitions, 6.2 Fundamental axes and part of a dumpy level, 6.3 Types of adjustments and objectives, 6.4 Temporary and Permanent adjustments of a dumpy level, 6.5 Sensitiveness of bubble tube, 6.6 Curvature and refraction correction, 6.7 Type of leveling, 6.8 Simple leveling, 6.9 Reciprocal leveling, 6.10 Profile leveling, 6.11 Cross sectioning, 6.12 Fly leveling,

7 Hours

UNIT 7:

Reduction of Levelling *continued....*

7.1 Booking of levels 7.2 Rise and fall method and Height of instrument method 7.3 comparison Arithmetic checks 7.4 Fly back leveling., 7.5 Errors and precautions.

6 Hours

Contouring

7.6 Contours and their characteristics, 7.7 Methods of contouring, 7.8 direct and indirect methods, 7.9 Interpolation techniques, 7.10 Uses of contours 7.11 Numerical problems on determining intervisibility, 7.12 Grade contours and uses.

4 Hours

UNIT 8:

Plane Table Surveying

8.1 Plane table and accessories, 8.2 Advantages and limitations of plane table survey, 8.3 Orientation and methods of orientation, 8.4 Methods of plotting – Radiation, Intersection, Traversing, 8.5 Resection method, 8.6 Two point and three point problems, 8.7 Solution to two point problem by graphical method,

8.8 Solution to three point problem Bessel's graphical method, 8.9 Errors in plane table survey.

5 Hours

TEXT BOOKS:

1. „**Surveying**“ Vol-1 – B.C. Punmia , Laxmi Publications, New Delhi.
2. **Surveying and Levelling** – R Subramanian. Oxford University Press (2007)

Text Book of Surveying – C. Venkataramiah. Universities Press.(2009 Reprint)

REFERENCE BOOKS:

1. **Fundamentals of Surveying** - Milton O. Schimidt – Wong, Cengage Learning.
 2. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India.
 3. **Surveying** Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.
- * Survey of India Publication on maps.

**FLUID MECHANICS
(COMMON TO CV/TR/EV)**

Sub Code	:	10 CV 35	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART-A

UNIT-1: BASIC PROPERTIES OF FLUIDS

Introduction, Definiton of Fluid, Systems of units, properties of fluid: Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension,& Capillarity. Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). **06 Hrs.**

UNIT-2: PRESSURE AND ITS MEASUREMENT

Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Vapour pressure. Measurement of pressure using a simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.
07 Hrs.

UNIT-3: HYDROSTATIC PRESSURE ON SURFACES

Basic definitions, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged laminae (plane and curved)- Problems. **06 Hrs**

UNIT-4: KINEMATICS OF FLOW

Introduction, methods of describing fluid motion, definitions of types of fluid flow, streamline, pathline, streakline and streamtube. One and Three dimensional continuity equation in Cartesian Coordinates (derivation and problems). Velocity potential, Stream function, Equipotential line, Stream line-problems, Physical concepts of Streamfunction. Introduction to flow net. **07 Hrs**

PART-B

UNIT-5: DYNAMICS OF FLUID FLOW

Introduction, Energy possessed by a fluid body. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). Introduction to kinetic energy correction factor. Momentum equation problems on pipe bends.

07 Hrs

UNIT-6: PIPE FLOW

Introduction, losses in pipe flow,. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion- problems. Water hammer in pipes, equation for pressure rise due to gradual valve closure & sudden closure for rigid and elastic pipes-problems.

07 Hrs

UNIT-7: DEPTH AND VELOCITY MEASUREMENTS

Introduction, Measurement of depth, point & hook gauges, self recording gauges. Staff gauge, Weight gauge, float gauge. Measurement of velocity- single and double gauges, pitot tube, Current meter- Problems.

06 Hrs

UNIT-8: DISCHARGE MEASUREMENTS

Introduction, Venturimeter, Orificemeter, Rotometer, Venturiflume, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir and Broad crested weir, Small orifices-Problems.

06 Hrs

TEXT BOOKS:

1. „A TextBook of Fluid mechanics & Hydraulic Machines“- R.K.Rajput, S.Chand & Co, New Delhi, 2006 Edition.

2. „Principles of Fluid Mechanics and Fluid Machines“- N.Narayana Pillai, Universities Press(India), Hyderabad,2009 Edition.
3. „ Fluid Mechanics and Turbomachines“- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

REFERENCE BOOKS:

1. „ Fundamentals of Fluid Mechanics“ – Bruce R. Munson, Donald F.Young, Theodore H. Okiishi, Wiley India, New Delhi, 2009 Edition.
 2. „Introduction To Fluid Mechanics“ – Edward j. Shaughnessy,jr; Ira m. Katz;; James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.
- „ Text Book Of Fluid Mechanics& Hydralic Machines“- R.K.Bansal, Laxmi Publications, New Delhi, 2008 Edition.

APPLIED ENGINEERING GEOLOGY

Sub Code	: 10 CV-36	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

PART – A

Unit: 1 - INTRODUCTION:

Geology and its role in the field of civil engineering. Earth: Its internal structure and composition. – 2 hours

MINERALOGY:

Description and identification of Rock forming minerals and Ores, based on physical and special properties;

Quartz and its varieties; Feldspar group; Mica group; carbonate group; Hornblende, Augite, Olivine, Asbestos, Kaolin, Talc, Gypsum, Garnet, Corundum.

Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. – 6 hours

Unit: 2- PETROLOGY:

Rocks as fundamental units and building materials of the earth crust and their engineering applications: As building stones, road metals and stones for decoration, pavement, cladding, roofing, flooring, concreting and foundation engineering.

Igneous rocks: Origin, classification (chemical and textural), mode of occurrence; Identification and description of Granite, Syenite, Diorite, Gabbro, Dunite; Pegmatite, Porphyries, Dolerite; Rhyolite, Basalt and Pumice.

Sedimentary rocks: Origin, classification, primary structures and description of Sandstones, Conglomerate, Breccia, Shale, Limestones and Laterite.

Metamorphic rocks: Kinds of metamorphism, description of Gneiss, Quartzite, Marble, Slate, Phyllite and Schists. – 6 hours

Unit: 3-GEOMORPHOLOGY:

Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures; Geological action of rivers with different drainage patterns; Geological action of wind. – 5 hours

Unit: 4-GEODYNAMICS:

Earthquakes- seismic waves, seismograph, causes, effects, seismic zones, shield areas and seismic resisting structures. Coastal zones, coastal landforms, continental shelf, continental rise, continental slope, abyssal plain, mid-oceanic ridges, trenches, tsunamis. Land slides; causes, effects and remedial measures – 5 hours

PART B

Unit: 5- ROCK MECHANICS:

Stress, strain and deformational effects on different rocks; Out crop, Dip, strike and escarpment, Clinometer-compass- Joints, faults, folds and unconformities their effects on civil engineering structures. – 6 hours

Unit:6- ENGINEERING GEOLOGY:

Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways – 6 hours

Unit: 7-HYDROGEOLOGY:

Hydrological cycle; distribution of ground water in the earth crust; properties of water bearing geological formation: Aquifers and their types; selection of sites for well locations and spacing of wells; geological, hydrological and geophysical (electrical resistivity) investigations for ground water exploration; artificial recharge of groundwater methods and rain water harvesting. Sea water intrusion and remedial measures. – 9 hours

Unit:8- GEOMATICS AND ENVIRONMENTAL GEOLOGY:

Introduction to remote sensing (RS), geographical information system (GIS) and global positioning system (GPS); land sate imageries, stereoscopes and their applications in civil engineering. Impact of quarrying, mining and dams on Environment. Quality of ground water in different geological terrain. – 7 hours

QUESTION PAPER PATTERN:

Question paper shall be consisting of eight full questions, selecting four from each part.

The student has to answer any five, selecting at least two from each part.

Each question carry 20 marks.

References books:

1. Text book of Geology by P.K. Mukerjee, World Press Pvt. Ltd. Kolkatta.

1. Foundations of Engineering Geology, by Tony Waltham (3rd Ed.) Universities Press.
2. Structural Geology (3rd Ed.) by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
3. Text of Engineering and General Geology by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi.
4. Rock Mechanics for Engineers by Dr B.P.Verma, Khanna Publishers, New Delhi.
5. Engineering Geology for Civil Engineering by D. Venkata Reddy, Oxford and IBH Publishing Company, New Delhi.
6. Ground water geology by Todd D.K. John Wiley and Sons, New York.
7. Remote sensing Geology by Ravi P Gupta, Springer Verilag, New York.
8. Physical Geology by Arthur Holmes, Thomson Nelson and Sons, London.
9. Environmental Geology by K. S. Valdiya, Tata Mc Graw Hills.
10. A text book of Engineering Geology by Chenna Kesavulu, Mac Millan India Ltd.
11. Remote sensing and GIS by M.Anji Reddy.

12. Ground water assessment, development and management by
K.R.Karant, Tata Mc Graw Hills

Civil Engineering MATERIAL TESTING LAB

(COMMON TO CV/TR)

Sub Code	:	10 CVL 37	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

1. Tension test on Mild steel and HYSD bars.
2. Compression test of Mild Steel, Cast iron and Wood.
3. Torsion test on Mild Steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel.
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's
8. Test on Bricks and Tiles
9. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant BIS Codes

REFERENCE BOOKS:

1. **Testing of Engineering Materials**, Davis, Troxell and Hawk, International Student Edition – McGraw Hill Book Co. New Delhi.
2. **Mechanical Testing of Materials**", Fenner, George Newnes Ltd. London.
3. **"Experimental Strength of Materials"**, Holes K A, English Universities Press Ltd. London.
4. **"Testing of Metallic Materials"**, Suryanarayana A K, Prentice Hall of India Pvt. Ltd. New Delhi.
5. **Relevant IS Codes**
6. **"Material Testing Laboratory Manual"**, Kukreja C B- Kishore K. Ravi Chawla Standard Publishers & Distributors 1996.
7. **Concrete Manual**, M.L.Gambhir –Dhanpat Rai & Sons- New Delhi.

Scheme of Examination:

Group Experiments: Tension, Compression Torsion and Bending Tests

Individual Experiments: Remaining tests

Two questions are to be set – one from group experiments and the other as individual experiment.

SURVEYING PRACTICE – I
(COMMON TO CV/TR/EV/CTM)

Sub Code	:	10 CVL 38	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Exercise – 1

- a) To measure distance between two points using direct ranging
- b) To set out perpendiculars at various points on given line using cross staff, optical square and tape.

Exercise – 2

Setting out of rectangle, hexagon using tape/chain and other accessories

Exercise – 3

Measurement of bearing of the sides of a closed traverse & adjustment of closing error by Bowditch method and Transit method

Exercise – 4

To set out rectangles, pentagon, hexagon, using tape /chain and compass.

Exercise – 5

To determine the distance between two inaccessible points using chain/tape & compass.

Exercise – 6

To locate points using radiation and intersection method of plane tabling

Exercise – 7

To solve 3-point problem in plane tabling using Bessel's graphical solution

Exercise –8

To determine difference in elevation between two points using fly leveling technique & to conduct fly back leveling. Booking of levels using both HI and Rise & Fall methods.

Exercise – 9

To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error

Exercise – 10

To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.

Demonstration

Minor instruments – Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph.

Scheme of Examination:

Any one of the above exercise is to be conducted in the examination by the student.

TEXT BOOKS:

1. „**Surveying**“ Vol.–1, B.C. Punmia , Laxmi Publications, New Delhi.
2. “**Plane Surveying**“ Vol-1-A.M. Chandra , Newage International ® Ltd.
3. „**Plane Surveying**“ – ALAK , S. Chand and Company Ltd., New Delhi.

REFERENCE BOOKS :

1. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India.
2. **Fundamentals of Surveying** - Milton O. Schmidt – Wong, Thomson Learning.
4. **Surveying** Vol. I, S.K. Duggal

ENGINEERING MATHEMATICS - IV

Sub Code	:	10MAT41	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

**CONCRETE TECHNOLOGY
(COMMON TO CV/TR/CTM)**

Sub Code	:	10 CV 42	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART – A

Unit- 1

Cement, Chemical composition, hydration of cement, Types of cement, manufacture of OPC by wet and dry, process (flow charts only) Testing of cement - Field testing, Fineness by sieve test and Blaine's air permeability test, Normal consistency, testing time, soundness, Compression strength of cement and grades of cement, Quality of mixing water. -7 Hours

Unit-2

Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. - 6 Hours

Unit-3

Workability - factors affecting workability, Measurement of workability - slump, flow tests, Compaction factor and vee-bee consistometer tests, Segregation and bleeding, Process of manufactures of concrete : Batching, Mixing, Transporting, Placing, Compaction, Curing. -7 Hours

Unit-4

Chemical admixtures - plasticizers, accelerators, retarders and air entraining agents, Mineral admixtures - Fly ash, Silica fumes, rice husk ash and GGBS. -6 Hours

Part-B

Unit-5

Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, relation between compressive strength, and tensile strength, bond strength, modulus of rupture, Accelerated curing, aggregate - cement bond strength, Testing of hardened concrete - compressive strength, split tensile strength, Flexural strength, factors influencing strength test results. - 6Hours

Unit-6

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson , Ratio, Shrinkage - plastic shrinkage

and drying shrinkage, Factors affecting shrinkage, Creep - Measurement of creep, factors affecting creep, effect of creep, - 7 Hours

Unit-7

Durability - definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing – remedial measures. - 6 Hours

Unit-8

Concept of Concrete Mix design, variables in proportioning , exposure conditions, Procedure of mix design as per IS 10262-2009, Numerical examples of Mix Design - 7 Hours

TEXT BOOKS:

1. "Concrete Technology" - Theory and Practice, M.S.Shetty, S.Chand and Company, New Delhi, 2002.
2. "Concrete Technology" – M.L.Gambhir, TATA McGRAW HILL, New Delhi.

REFERENCES :

1. "Properties of Concrete"Neville, A.M. : , ELBS, London
2. "Concrete Technology" – A.R.Santakumar. Oxford University Press (2007)"
3. "Concrete Mix Design" - N.Krishna Raju, Sehgal - publishers.
4. "Recommended guidelines for concrete mix design" - IS:10262,BIS Publication

STRUCTURAL ANALYSIS –I (COMMON TO CV/TR)

Sub Code	:	10 CV 43	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

STRUCTURAL SYSTEMS AND ENERGY CONCEPT

1.1 Introduction, 1.2 Forms of structures – One, Two & Three dimensional structural systems, 1.3 Degrees of Freedom, 1.2 Conditions of equilibrium, 1.3 Degree of freedom (Kinematic indeterminacy) 1.4 Determinate and indeterminate structures-Static indeterminacy, 1.5 Linear and Non linear structures, 1.6 Strain energy and complimentary strain energy, 1.8 Strain energy due to axial load, bending and shear, 1.9 Theorem of minimum potential energy, 1.10 Law of conservation of energy, 1.11 Principle of virtual work,

7 Hours

**UNIT 2:
DEFLECTION OF BEAMS**

2.1 Moment area method, 2.2 Conjugate beam method

6 Hours

**UNIT 3:
DEFLECTION OF BEAMS AND TRUSSES BY STRAIN ENERGY**

3.1 The first and second theorem of Castigliano's, problems on beams, bents and trusses, 3.2 Betti's law, 3.3 Clarke - Maxwell's theorem of reciprocal deflection (Static and Kinematic indeterminacy less than/equal to 2).

7 Hours

**UNIT 4:
ANALYSIS OF BEAMS AND PLANE FRAMES BY STRAIN ENERGY**

4.1 Analysis of beams (Propped cantilever and Fixed beams) and trusses using strain energy and unit load methods (Static and Kinematic indeterminacy less than/equal to 2)

7 Hours

PART – B

**UNIT 5:
ARCHES AND CABLES**

5.1 Introduction, 5.2 Three hinged circular and parabolic arches with supports at same levels and different levels, 5.3 Determination of thrust, shear and bending moment, 5.4 Analysis of cables under point loads and UDL, length of cables (Supports at same levels and at different levels).

6 Hours

**UNIT 6:
ANALYSIS OF BEAMS**

6.1 Consistent deformation method – Propped cantilever and fixed beams

6 Hours

UNIT 7:

7.1 Clapeyron's theorem of three moments – Derivation of equation, continuous beams and fixed beams-related problems.

6 Hours

UNIT 8:

ANALYSIS OF ARCHES

8.1 Two hinged parabolic arch, 8.2 Two hinged Circular Arch.

7

Hours

TEXT BOOKS:

1. **Theory of Structures**, Pandit and Guptha, Vol. – I, Tata McGraw Hill, New Delhi.
2. **Basic Structural Analysis** Reddy C. S., Tata McGraw Hill, New Delhi.
3. **Strength of Materials and theory of structures** Vol I & II, B.C. Purnia , R.K., Jain Laxmi Publication New Delhi

REFERENCE BOOKS:

1. **Elementary Structural Analysis**, Norris and Wilbur, International Student Edition. McGraw Hill Book Co: New York
2. **Structural Analysis**, 4th SI Edition by Amit Prasanth & Aslam Kassimali, Cengage Learning.
3. **Analysis of Structures**, Thandava Murthy, Oxford University Press, Edition 2005.

SURVEYING – II
(COMMON TO CV/TRE/VE/CTM)

Sub Code	:	10 CV 44	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:
THEODOLITE SURVEY

1.1 Theodolite and types, 1.2 Fundamental axes and parts of a transit theodolite, 1.3 Uses of theodolite, 1.4 Temporary adjustments of a transit theodolite, 1.5 Measurement of horizontal angles – Method of repetitions and reiterations, 1.6 Measurements of vertical angles, 1.7 Prolonging a straight line by a theodolite in adjustment and theodolite not in adjustment

6 Hours

UNIT 2:
PERMANENT ADJUSTMENT OF DUMPY LEVEL AND TRANSIT THEODOLITE

2.1 Interrelationship between fundamental axes for instrument to be in adjustment and step by step procedure of obtaining permanent adjustments

7 Hours

UNIT 3:
TRIGONOMETRIC LEVELING

3.1 Determination of elevation of objects when the base is accessible and inaccessible by single plane and double plane method, 3.2 Distance and difference in elevation between two inaccessible objects by double plane method. Salient features of Total Station, Advantages of Total Station over conventional instruments, Application of Total Station.

8 Hours

UNIT 4:
TACHEOMETRY

4.1 Basic principle, 4.2 Types of tacheometric survey, 4.3 Tacheometric equation for horizontal line of sight and inclined line of sight in fixed hair method, 4.4 Anallactic lens in external focusing telescopes, 4.5 Reducing the

constants in internal focusing telescope, 4.6 Moving hair method and tangential method, 4.7 Substance bar, 4.8 Beaman stadia arc.

7 Hours

PART – B

UNIT 5:

CURVE SETTING (Simple curves)

Curves – Necessity – Types, 5.2 Simple curves, 5.3 Elements, 5.4 Designation of curves, 5.5 Setting out simple curves by linear methods, 5.6 Setting out curves by Rankine's deflection angle method.

CURVE SETTING (Compound and Reverse curves)

Compound curves 5.2 Elements 5.3 Design of compound curves 5.4 Setting out of compound curves 5.5 Reverse curve between two parallel straights (Equal radius and unequal radius).

10 Hours

UNIT 6:

6.1 Triangulation Survey: Figures and systems, system of framework, baseline measurement, base measurement by rigid bar and flexible apparatus, tape correction, Measurement of angles, satellite station and reduction to centre and field checks in triangulation and principle of least squares, triangulation adjustment- angle and station

6

Hours

UNIT 7:

CURVE SETTING (Transition and Vertical curves)

7.1 Transition curves 7.2 Characteristics 7.3 Length of Transition curve 7.4 Setting out cubic Parabola and Bernoulli's Lemniscates, 7.5 Vertical curves – Types – Simple numerical problems.

6 Hours

UNIT 8:

AREAS AND VOLUMES

8.1 Calculation of area from cross staff surveying, 8.2 Calculation of area of a closed traverse by coordinates method. 8.3 Planimeter – principle of working and use of planimeter to measure areas, digital planimeter, 8.4 Computations of volumes by trapezoidal and prismoidal rule, 8.5 Capacity contours

6 Hours

TEXT BOOKS:

- 1.,,Surveying" Vol 2 and Vol 3 - B. C. Punmia, Laxmi Publications
- 2.,,Plane Surveying" A. M. Chandra – New age international (P) Ltd
- 3.,,Higher Surveying" A.M. Chandra New age international (P) Ltd

REFERENCE BOOKS:

1. **Fundamentals of Surveying** - Milton O. Schmidt – Wong, Cengage Learning.
2. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India
3. **Surveying**, Arther Bannister et al., Pearson Education, India

**HYDRAULICS & HYDRAULIC MACHINES
(COMMON TO CV/TR/EV)**

Sub Code	:	10 CV 45	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART-A

UNIT-1: DIMENSIONAL ANALYSIS AND MODEL STUDIES

Introduction, Systems of units, Dimensions of quantities, Dimensional Homogeneity of an equation. Analysis- Raleigh’s method, Buckingham’s II theorem- problems.

Model Studies, Similitude, Non-dimensional numbers: Froude models-Undistorted and Distorted models. Reynold’s models-

Problems **07 hrs**

UNIT-2: UNIFORM FLOW IN OPEN CHANNELS

Introduction, Geometric properties of Rectangular, Triangular, Trapezoidal and Circular channels. Chezy’s equation, Manning’s equation-problems.

Most economical open channels-Rectangular, Triangular, Trapezoidal and Circular channels- problems.

06 Hrs

UNIT-3: NON-UNIFORM FLOW IN OPEN CHANNELS

Introduction, Specific energy, Specific energy diagram, Critical depth, Conditions for Critical flow- Theory & problems.

Hydraulic jump in a Horizontal Rectangular Channel- Theory and problems.

Dynamic equation for Non-Uniform flow in an Open channel, Classification of Surface profiles- simple Problems.

07 Hrs

UNIT-4: IMPACT OF JET ON FLAT VANES

Introduction, Impulse- Momentum equation. Direct impact of a jet on a stationary flat plate, Oblique impact of a jet on a stationary flat plate, Direct impact on a moving plate, Direct impact of a jet on a series of flat vanes on a wheel. Conditions for maximum hydraulic efficiency. Impact of a jet on a hinged flat plate- problems.

06 Hrs

PART-B

UNIT-5: IMPACT OF JET ON CURVED VANES

Introduction, Force exerted by a jet on a fixed curved vane, moving curved vane.

Introduction to concept of velocity triangles, Impact of jet on a series of curved vanes-problems.

06 Hrs

UNIT-6: PELTON WHEEL

Introduction to Turbines, Classification of Turbines. Pelton wheel- components, working and velocity triangles. Maximum power, efficiency, working proportions- problems.

07 Hrs

UNIT-7: KAPLAN TURBINES

Introduction, Components, Working and Velocity triangles, Properties of the Turbine, Discharge of the Turbines, Number of Blades-Problems. Draft Tube: Types, efficiency of a Draft tube. Introduction to Cavitation in Turbines.

07 Hrs

UNIT-8: CENTRIFUGAL PUMPS

Introduction, Classification, Priming, methods of priming. Heads and Efficiencies. Equation for work done, minimum starting speed, velocity triangles. Multistage Centrifugal Pumps (Pumos in Series and Pumps in parallel). Characteristic Curves for a Single stage Centrifugal Pumps- problems.

06 Hrs

TEXT BOOKS:

4. „A TextBook of Fluid mechanics & Hydraulic Machines“- R.K.Rajput, S.Chand & Co, New Delhi, 2006 Edition.

5. „Text Book Of Fluid Mechanics& Hydraulic Machines“- R.K.Bansal, Laxmi Publications, New Delhi, 2008 Edition.
3. „Fluid Mechanics and Turbomachines“- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

REFERENCE BOOKS:

3. „Introduction to Fluid Mechanics“ – Robert w. Fox: Philip j. Pritchard: Alan t. McDonald, Wiley India, New Delhi, 2009 Edition.
4. „Introduction To Fluid Mechanics“ – Edward j. Shaughnessy,jr; Ira m. Katz;; James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.
5. „Hydraulics and Fluid Mrchanics“ – Dr. P.N. Modi& Dr S.M. Seth, Standard Book House- New Delhi. 2009 Edition..

**BUILDING PLANNING AND DRAWING
(COMMON TO CV/TR)**

Sub Code	: 10 CV 46	IA Marks	: 25
Hrs/ Week	: 06 (3 x 2 = 6) Practical	Exam Hours	: 04
	01 Theory	Exam Marks	: 100

1. To prepare geometrical drawing of component of buildings i) Stepped wall footing and isolated RCC column footing, ii) Fully paneled and flush doors, iii) Half paneled and half-glazed window, iv) RCC dog legged and open well stairs, v) Steel truss.

15 Hours

2. Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.

9 Hours

3. Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings, i) Two bed

room building, ii) Two storeyed building.

27 Hours

- 4 Functional design of building using inter connectivity diagrams (bubble diagram), development of line diagram only for following building i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building

12 Hours

- 5 For a given single line diagram, preparation of water supply, sanitary and electrical layouts

6 Hours

REFERENCE BOOKS:

- 1 **“Building Drawing”**, Shah M.H and Kale C.M, Tata Mc Graw Hill Publishing co. Ltd., New Delhi.
- 2 **“Building Construction”**, Gurucharan Singh, Standard Publishers & distributors, New Delhi.
- 3 **National Building Code**, BIS, New Delhi.

IA MARKS

15 Marks for term work.

10 Marks for a test conducted at the end of the semester of 4hrs duration on the Line of VTU examination.

TERM WORKS DETAILS:

- Sheet No: 1 to 4 from chapter No1**
Sheet No: 5 to 8 from chapter No3
Sheet No: 9 to 13 from chapter No4
Sheet No: 14 & 15 from chapter No5

SCHEME OF EXAMINATION

- Section-I** Compulsory question from chapter No 3 for 60 Marks
Plan25
Elevation.....15 60
Section.....15
Schedule of opening 05

- Section-II** Four questions from chapters 1, 2, 4 and 5 should be set, out of which two have to be answered (20 x 2 = 40 Marks).

Note: No theory question shall be asked from any chapter.

**SURVEYING PRACTICE – II LABORATORY
(COMMON TO CV/TR/CTM)**

Sub Code	:	10 CVL 47	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

Exercise – 1

Measurement of horizontal angles with method of repetition and reiteration using theodolite, Measurement of vertical angles using theodolite.

Exercise – 2

To determine the elevation of an object using single plane method when base is accessible and inaccessible.

Exercise – 3

To determine the distance and difference in elevation between two inaccessible points using double plane method.

Exercise – 4

To determine the tachometric constants using horizontal and inclined line of sight.

Exercise – 5

To set out simple curves using linear methods – perpendicular offsets from long chord and offsets from chords produced.

Exercise – 6

To set out simple curves using Rankine's deflection angles method.

Exercise – 7

To set out compound curve with angular methods with using theodolite only.

Exercise – 8

To set out the center line of a simple rectangular room using offset from base line

Exercise – 9

To set out center lines of columns of a building using two base lines at right angles

Demonstration

Exposure to use of Total Station. Traversing, Longitudinal sections, Block levelling, Usage of relevant softwares for preparation of the contour drawings.

Scheme of Examination:

Any one of the above exercise is to be conducted in the examination by the student.

**APPLIED ENGINEERING GEOLOGY LABORATORY
(COMMON TO CV/TR)**

Sub Code	:	10 CVL 48	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	50

1. Describe and identify the minerals based on their physical, special properties, chemical composition and uses. Study of important rock forming minerals, ores and other important industrial minerals. (As per the III semester theory syllabus) – 2 practicals
2. Describe and identify the rocks as per the theory syllabus by giving their physical properties and engineering uses. – 2 practicals
3. Study of Geological maps and their sections: interpreting them in terms of selecting the sites for various civil engineering structures. - 3 practicals
4. Dip and strike (surface method) problems: To find out the dip and strike of the geological formation to select suitable site for civil engineering structures. – 2 practicals
5. Borehole problems (sub surface dip and strike): three point level ground methods: - 2 practicals
6. Thickness of strata (out crops) problems: To determine the true thickness, vertical thickness and the width of the out crops on different topographical terrain. – 1 practical

7. Field visit to Civil engineering projects –Dams, Reservoirs, Harbours etc. – 3 days

Scheme of Examination

1. Identification of Minerals (5 Nos.): 5x2 : 10 marks
2. Identification of Rocks (5Nos.): 5x2 : 10 marks
3. Geological Map: 1x 15 : 15 marks
4. Borehole Problems: 1x 05 : 05 marks
5. Dip and Strike Problems: 1x04 : 04 marks
6. Thickness of strata problems: 1x03 : 03 marks
7. Viva- Voce: 03 marks

I.A. Marks should be assessed by conducting a test for 10 Marks and 15 Marks for practical record. (Total Marks: 25)

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	: 10AL51	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management – Management as a science, art or profession – Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization – principles of organization – Types of organization – Departmentation – Committees – Centralisation Vs Decentralisation of authority and responsibility – Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Coordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

7 Hours

PART - B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur, Evolution of Concept, Functions of Entrepreneur, Types of Entrepreneur, Entrepreneur – An emerging class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process, Role of Entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

7 Hours

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives, Scope, role of SSI in Economic Development. Advantages of SSI. Steps to start an SSI – Government policy towards SSI, Different Policies of SSI., Government Support on SSI., during 5 year plans. Impact of Liberalization, Privatisation, Globalization on SSI. Effect of WTO / GATT Supporting Agencies of Government for SSI Meaning. Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes, TECKSOK, KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI, NSIC, SIDBI, KSFC.

6 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project, Project Identification, Project Selection, Project Report, Need and significance of Project, Contents, formulation, Guidelines by Planning Commission for Project Report, Network Analysis, Errors of Project Report, Project Appraisal. Identification of Business Opportunities. Market Feasibility Study: Technical Feasibility Study, Financial Feasibility Study & Social Feasibility Study.

TEXT BOOKS:

1. **Principles of Management** – P.C. Tripathi, P.N. Reddy, 4th Edition, Tata McGraw Hill, New Delhi.
2. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
3. **Entrepreneurship Development** – Small Business Enterprises – Poornima M. Charantimath – Pearson Education – 2006.

REFERENCE BOOKS:

1. **Management Fundamentals** – Concepts, Application, Skill Development – Robert Lusier – Thomson.
2. **Entrepreneurship Development** – SS Khanka – S Chand & Co.
3. **Management** – Stephen Robbins – Pearson Education / PHI – 17th Edition, 2003.
4. **Management & Entrepreneurship** by N V R Naidu & T Krishna Rao – I K International Publishing House Pvt. Ltd. 1st edition

DESIGN OF RCC STRUCTURAL ELEMENTS

Subject Code	: 10CV52	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

GENERAL FEATURES OF REINFORCED CONCRETE: Introduction, Design Loads, Materials for Reinforced Concrete and Code requirements. Design Philosophy – Limit State Design principles. Philosophy of limit state design, Principles of limit states, Factor of Safety, Characteristic and design loads, Characteristic and design strength.

6 Hours

UNIT - 2**PRINCIPLES OF LIMIT STATE DESIGN AND ULTIMATE**

STRENGTH OF R.C. SECTION: General aspects of Ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of singly reinforced rectangular sections, Ultimate flexural strength of doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples of singly reinforced, doubly reinforced, flanged sections, shear strength and development length.

7 Hours

UNIT - 3

FLEXURE AND SERVICEABILITY LIMIT STATES: General

Specification for flexure design of beams-practical requirements, size of beam, cover to reinforcement-spacing of bars. General aspects of serviceability-Deflection limits in IS: 456 – 2000-Calculation of deflection (Theoretical method), Cracking in structural concrete members, Calculation of deflections and crack width.

6 Hours

UNIT - 4

DESIGN OF BEAMS: Design procedures for critical sections for moment and shears. Anchorages of bars, check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for Simply supported and Cantilever beams for rectangular and flanged sections.

8 Hours

PART - B**UNIT - 5**

DESIGN OF SLABS: General consideration of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of simply supported, cantilever and continuous slabs as per IS: 456 – 2000.

8 Hours

UNIT - 6

DESIGN OF COLUMNS: General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, design of short axially loaded columns, design of column subject to combined axial load and uniaxial moment and biaxial moment using SP – 16 charts.

5 Hours

UNIT - 7

DESIGN OF FOOTINGS: Introduction, load for footing, Design basis for limit state method, Design of isolated rectangular footing for axial load and uniaxial moment, design of pedestal.

6 Hours

UNIT - 8

DESIGN OF STAIR CASES: General features, types of stair case, loads on stair cases, effective span as per IS code provisions, distribution of loading on stairs, Design of stair cases. With waistlabs.

6 Hours

REFERENCE BOOKS:

1. **Limit State Design of Reinforced concrete**-by P.C. Varghese, PHI Learning Private Limited 2008-2009

2. **Fundamentals of Reinforced concrete Design**-by M.L.Gambhir, PHI Learning Private Limited 2008-2009.
3. **Reinforced concrete Design**-by Pallai and Menon, TMH Education Private Limited,
4. **Reinforced concrete Design**-by S.N.Shinha, TMH Education Private Limited,
5. **Reinforced concrete Design**-by Karve & Shaha, Structures Publishers Pune.
6. **Design of RCC Structural Elements** S. S. Bhavikatti, Vol-I, New Age International Publications, New Delhi.
7. **IS-456-2000 and SP-16**

STRUCTURAL ANALYSIS – II

Subject Code	: 10CV53	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

ROLLING LOAD AND INFLUENCE LINES: Introduction to Rolling loads on Simply Supported Beams. Influence line diagram for reaction, SF and BM in simply supported beams subjected several point loads and udl.

**6
Hours**

UNIT - 2

SLOPE DEFLECTION METHOD: Introduction, Sign convention, Development of slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)

8 Hours

UNIT - 3

MOMENT DISTRIBUTION METHOD: Introduction, Definition of terms-Distribution factor, Carry over factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames (non-sway) with kinematic redundancy less than/equal to three. (Members to be axially rigid)

8 Hours

UNIT - 4

SWAY ANALYSIS: Analysis of rigid jointed plane frames (sway, members assumed to be axially rigid and kinematic redundancy ≤ 3) by slope deflection and moment distribution methods.

4 Hours

PART - B

UNIT - 5

KAN'S METHOD: Introduction, Basic Concept, Analysis of Continuous beams and Analysis of rigid jointed non-sway plane frames.

6 Hours

UNIT - 6

FLEXIBILITY MATRIX METHOD OF ANALYSIS: Introduction, Development of flexibility matrix for plane truss element and axially rigid plane framed structural elements and Analysis of plane truss and axially rigid plane frames by flexibility method with static indeterminacy ≤ 3 (System Approach).

7 Hours

UNIT - 7

STIFFNESS MATRIX METHOD OF ANALYSIS: Introduction, Development of stiffness matrix for plane truss element and axially rigid plane framed structural elements. And Analysis of plane truss and axially rigid plane frames by stiffness method with kinematic indeterminacy ≤ 3 (System Approach).

7 Hours

UNIT - 8

BASIC PRINCIPLES OF DYNAMICS: Basic principles of Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion. Period, frequency and damping. Forced and Free Vibrations - Equations of Single Degree of Freedom System with and without damping: related problems.

6 Hours

REFERENCE BOOKS:

1. **Basic Structural Analysis**- Reddy C.S. - Second Edition, Tata McGraw Hill Publication Company Ltd.
2. **Theory of Structures Vol. 2** - S.P. Gupta, G.S. Pandit and R. Gupta, Tata McGraw Hill Publication Company Ltd.
3. Structural Dynamics-by M.Mukhopadhyay,
4. **Structural Analysis-II** -S. S. Bhavikatti – Vikas Publishers, New Delhi.

5. **Basics of Structural Dynamics and Aseismic Design** By Damodhar Swamy and Kavita PHI Learning Private Limited
6. **Structural Analysis**- D.S. Prakash Rao,, A Unified Approach, University Press
7. **Structural Analysis**, 4th SI Edition by Amit Prasanth & Aslam Kassimali, Cengage Learning.

GEOTECHNICAL ENGINEERING – I

Subject Code	: 10CV54	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT- 1

INTRODUCTION: History of soil mechanics, Definition, origin and formation of soil. Phase Diagram, Voids ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Water content, Specific Gravity of soil solids and soil mass, Densities and Unit weights - Bulk, Dry, Saturated & Submerged and their inter relationships.

6 Hours

UNIT - 2

INDEX PROPERTIES OF SOIL AND THEIR DETERMINATION:

Index Properties of soil- Water content , Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, in-situ density, Activity of Clay, Laboratory methods of determination of index properties of soil: Water content (Oven Drying method & Rapid Moisture method), Specific gravity of soil solids (Pycnometer and density bottle method), Particle size distribution (Sieve analysis and Hydrometer analysis only), Liquid Limit- (Casagrande and Cone penetration methods), Plastic limit and shrinkage limit.

7 Hours

UNIT - 3

CLASSIFICATION OF SOILS: Purpose of soil classification, Particle size classification – MIT classification and IS classification, Textural classification. IS classification - Plasticity chart and its importance, Field identification of soils.

CLAY MINERALOGY AND SOIL STRUCTURE: Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

8 Hours

UNIT - 4

FLOW OF WATER THROUGH SOILS: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, quick sand phenomena, Capillary Phenomena.

6 Hours

PART - B

UNIT - 5

SHEAR STRENGTH OF SOIL: Concept of shear strength, Mohr-coulomb theory, conventional and modified failure envelopes, Effective stress concept-total stress, effective stress and Neutral stress, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay.

7 Hours

UNIT - 6

COMPACTION OF SOIL: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control – compactive effort & method, lift thickness and number of passes, Proctor's needle, Compacting equipment.

6 Hours

UNIT - 7

CONSOLIDATION OF SOIL: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (C_c , a_v , m_v and C_v).

6

Hours

UNIT- 8

DETERMINATION OF SHEAR STRENGTH AND

CONSOLIDATION OF SOIL: Measurement of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Test under different drainage conditions.

Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils-compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method).

6 Hours

TEXT BOOKS:

1. **Soil Mechanics and Foundation Engg.-** Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi.
2. **Principles of Soil Mechanics and Foundation Engineering-** Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
3. **Geotechnical Engineering;** Braja, M. Das (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India

REFERENCES BOOKS:

1. **Foundation Analysis and Design-** Bowles J.E. (1996), 5th Edition, McGraw Hill Pub. Co. New York.
2. **Soil Engineering in Theory and Practice-** Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.
3. **Basic and Applied Soil Mechanics-** Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
4. **Geotechnical Engineering-** Donald P Coduto Phi Learning Private Limited, New Delhi
5. **Geotechnical Engineering-** Shashi K. Gulathi & Manoj Datta. (2009), “ Tata Mc Graw Hill.
6. **Text Book of Geotechnical Engineering-** Iqbal H. Khan (2005),, 2nd Edition, PHI, India.

Numerical Problems, Examples and objective questions in Geotechnical Engineering- **Narasimha Rao A. V. & Venkatrahmaiah C. (2000), Universities Press., Hyderabad**

7.

Hydrology and Irrigation Engineering

Sub Code	:	10CV55	IA Marks	:	25
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	100

PART-A

HYDROLOGY

UNIT 1: INTRODUCTION & PRECIPITATION

Introduction ,Hydrologic cycle (Horton’s representation). Water budget equation

Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation (Simon’s gauge & Syphon gauge only), selection of rain gauge station. Adequacy

of raingauges, methods of computing average rainfall, interpolation of missing data, adjustment of missing data by double mass curve method. Hyetograph and mass curve of rainfall, 07 hrs

UNIT 2 : LOSSES FROM PRECIPITATION

Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer's and Rohwer's equation), evaporation control.

Evapo-transpiration: Definition, factors affecting, measurement, estimation (Blaney criddle method)

Infiltration: Definition, factors affecting, measurement (double ring infiltrometer), infiltration indices, Horton's equation of infiltration. 07 hrs

UNIT 3: HYDROGRAPHS

Definition, components of hydrographs, unit hydrograph and its derivation from simple storm hydrograph, base flow separation, Prepositions of unit hydrograph- problems

06 hrs

UNIT 4: ESTIMATION OF FLOOD & FLOOD ROUTING

Definition of flood, factors affecting flood, methods of estimation (envelope curves, empirical formulae, rational method).

Flood routing: Introduction to hydrological routing, relationship of out flow and storage, general storage equation, Muskingum routing method. 07 hrs

PART-B

IRRIGATION ENGINEERING

UNIT 5 : INTRODUCTION

Introduction, need for irrigation, advantages and disadvantages of irrigation, environmental impacts of irrigation, Systems of

irrigation: Gravity irrigation, lift irrigation, well irrigation, tube well irrigation, infiltration galleries, sewage irrigation, supplemental irrigation.

06 hrs

UNIT 6: SOIL-WATER-CROP RELATIONSHIP

Introduction, soil profile, physical properties of soil, soil classification. Indian soils, functions of irrigation soils, maintaining soil fertility, soil-water-plant relationship, soil-moisture. Irrigation relationship, frequency of irrigation.

06 hrs

UNIT 7: WATER REQUIREMENT OF CROPS

Introduction, definitions, crop seasons of India, water requirement of a crop, duty, delta, base period. Consumptive use. Irrigation efficiencies. Assessment of irrigation water.

07 hrs

Unit 8: Canals

Definition, Types of canals, Alignment of canals, Design of canals by Kenedy's and Lacey's methods- Problems

06 hrs

TEXT BOOKS:

1. Engineering Hydrology – Subramanya.K; Tata Mcgraw Hill NewDelhi-2008 (Ed)
2. Hydrology- Madan Mohan Das, Mim Mohan Das-PHI Learning private Ltd. New Delhi-2009 (Ed)
3. A Text Book Of Hydrology- Jayarami Reddy, Laksmi Publications, New Delhi-2007 (Ed)
4. Irrigation, water Resources and water power Engineering- P.N.Modi- standard book house, New Delhi.

5. Irrigation and Water Power Engineering-Madan Mohan Das & Mimi Das Saikia; PHILearning pvy. Ltd. New Delhi 2009 (Ed).

REFERENCE BOOKS:

1. Hydrology & Soil Conservation Engineering- Ghanshyam Das- PHI Learning Private Ltd., New Delhi-2009 (Ed)
2. Hydrology & Water Resources Engineering- Patra K.C. Narosa Book Distributors Pvt. Ltd. New Delhi-2008 (Ed)
3. Hydrology & Water Resources Engineering- R.K.Sharma & Sharma, Oxford and Ibh, New Delhi
4. Irrigation Engineering and Hydraulic structures- S. K. garg- Khanna Publication, New Delhi.

TRANSPORTATION ENGINEERING I

Subject Code	:10CV56
I A Marks	:25
No. of lecture Hours/week	:04
Exam Hours	:03
Total No. of Lecture Hours	:52
Exam Marks	:100

PART – A

UNIT – 1

PRINCIPLES OF TRANSPORTATION ENGINEERING:

Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute

04 Hrs

UNIT – 2

HIGHWAY DEVELOPMENT AND PLANNING: Road

types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDC) Road development plan - vision 2021.

06 Hrs

UNIT – 3

HIGHWAY ALIGNMENT AND SURVEYS: Ideal

Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects

04 Hrs

HIGHWAY GEOMETRIC DESIGN – I: Importance, Terrain classification, Design speed, Factors affecting geometric design, **Cross sectional elements**-Camber- width of pavement-Shoulders-, Width of formation- Right of way, Typical cross sections **Sight Distance**-Restrictions to sight distance- Stopping sight distance- Overtaking sight distance- overtaking zones- Examples on SSD and OSD- Sight distance at intersections.

07 Hrs

UNIT – 4

HIGHWAY GEOMETRIC DESIGN – II: Horizontal

alignment-Radius of Curve- Superelevation – Extra widening- Transition curve and its length, setback distance – Examples, **Vertical alignment**-Gradient-summit and valley curves with examples.

05 Hrs

PART - B

UNIT – 5

PAVEMENT MATERIALS: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction-Examples on CBR and Modulus of subgrade reaction, **Aggregates**- Desirable properties and list of tests, **Bituminous materials**-Explanation on Tar, bitumen, cutback and emulsion-List of tests on bituminous materials **06 Hrs**

UNIT – 6

PAVEMENT DESIGN: Pavement types, component parts of flexible and rigid pavements and their functions, design factors, ESWL and its determination-Examples, **Flexible pavement**- Design of flexible pavements as per IRC:37-2001-Examples, **Rigid pavement**- Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC:58-2002

06 Hrs

UNIT – 7

PAVEMENT CONSTRUCTION: Earthwork –cutting-Filling, Preparation of subgrade, Specification and construction of i) Granular Subbase, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads **05**

Hrs

HIGHWAY DRAINAGE: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials

03 Hrs

UNIT – 8

HIGHWAY ECONOMICS: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost

method-Benefit Cost Ratio method-NPV-IRR methods-
Examples, Highway financing-BOT-BOOT concepts

06 Hrs

TEXT BOOKS:

- 1. Highway Engineering** – S K Khanna and C E G Justo, Nem Chand Bros, Roorkee
- 2. Highway Engineering** - L R Kadiyali, Khanna Publishers, New Delhi
- 3. Transportation Engineering** – K P Subramaniam, Scitech Publications, Chennai
- 4. Transportation Engineering** – James H Banks, Mc. Graw. Hill Pub. New Delhi
- 5. Highway Engineering** –R. Sreenivasa Kumar, University Press. Pvt. Ltd. Hyderabad

REFERENCE BOOKS:

- 1. Relevant IRC Codes**
- 2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.**
- 3. Transportation Engineering** – C. Jotin Khisty, B. Kent lal, PHI Learning Pvt. Ltd. New Delhi.

**HYDRAULICS AND HYDRAULICS MACHINERY
LABORATORY**

Sub Code	:	10CV 57	IA Marks	:	25
Hrs/ Week	:	03	Exam Hours	:	03
Total Hrs.	:	42	Exam Marks	:	100

1. Calibration of collecting tank (gravimetric method)
2. Calibration of pressure gauge (dead weight method)
3. Verification of Bernoulli's equation
4. Calibration of 90° V-notch
5. Calibration of Rectangular and Cipolletti notch
6. Calibration of Broad- crested weir
7. Calibration of Venturiflume
8. Calibration of Venturimeter

9. Determination of Darcy's friction factor for a straight pipe
10. Determination of Hydraulic coefficients of a vertical orifice
11. Determination of vane coefficients for a flat vane & semicircular vane
12. Performance characteristics of a single stage centrifugal pump
13. Performance characteristics of a Pelton wheel
14. Performance characteristics of a Kaplan turbine

Reference:

Experiments in Fluid Mechanics – Sarbjit Singh- PHI Pvt. Ltd.- NewDelhi- 2009-12-30
 Hydraulics and Hydraulic Mechines Laboratory Manual – Dr. N. Balasubramanya

COMPUTER AIDED DESIGN LABORATORY

Subject Code	: 10CVL58	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. AUTOCAD

Basics of AUTOCAD:

DRAWING TOOLS: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, *Modify tools:* Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, *Using Text:* Single line text, Multiline text, Spelling, Edit text, *Special Features:* View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

3 Hours

Use of AUTOCAD in Civil Engineering Drawings:

Following drawings are to be prepared for the data given using AUTOCAD

- i) Cross section of Foundation - masonry wall, RCC columns (isolated)
- ii) Different types of staircases
- iii) Lintel and chajja

iv) RCC slabs and beams

v) Drawing of Plan, elevation and sectional elevation of single storied residential and public buildings given the single line diagram and preparing excavation plan.

18 Hours

2. STRUCTURAL ANALYSIS SOFTWARE

Use of commercially available software for the analysis of

- i) Plane Trusses
- ii) Continuous beams
- iii) 2D Portal frames-single storied and multistoried

9Hours

3. USE OF EXCEL IN CIVIL ENGINEERING PROBLEMS

Use of spread sheet for the following civil engineering problems

- i) SFD and BMD for Cantilever and simply supported beam subjected to uniformly distributed and uniformly varying load acting throughout the span
- ii) Design of singly reinforced and doubly reinforced rectangular beams
- iii) Computation of earthwork
- iv) Design of horizontal curve by offset method
- v) Design of super elevation

12 Hours

REFERENCE BOOKS:

1. **Computer Aided Design Laborator-** Dr M.N.Shesha Prakash, Dr.G.S.Suresh, Lakshmi Publications
2. **CAD Laboratory-** M.A.Jayaram, D.S.Rajendra Prasad- Sapna Publications
3. **AUTOCAD 2002-** Roberts JT, -BPB publications
4. **AUTOCAD 2004-** Sham Tickoo, A beginner's Guide, Wiley Dreamtech India Pvt Ltd.,
5. **Learning Excel 2002-** Ramesh Bangia, -Khanna Book Publishing Co (P) Ltd.,
6. **Microsoft Excel-** Mathieson SA, Starfire publishers

VI SEMESTER

ENVIRONMENTAL ENGINEERING-I

Subject Code	: 10CV61	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

Part - A

Unit - 1

INTRODUCTION: Human activities and environmental pollution. Water for various beneficial uses and quality requirement. Need for protected water supply.

2 Hours

DEMAND OF WATER: Types of water demands- domestic demand in detail, institutional and commercial, public uses, fire demand. Per capita consumption –factors affecting per capita demand, population forecasting, different methods with merits &demerits- variations in demand of water. Fire demand – estimation by Kuichling’s formula, Freeman formula & national board of fire underwriters formula, peak factors, design periods & factors governing the design periods

6 Hours

Unit - 2

SOURCES: Surface and subsurface sources – suitability with regard to quality and quantity.

3 Hours

COLLECTION AND CONVEYANCE OF WATER: Intake structures – different types of intakes; factor of selection and location of intakes. Pumps- Necessity, types – power of pumps; factors for the selection of a pump. Pipes – Design of the economical diameter for the rising main; Nomograms – use; Pipe appurtenances.

6 Hours

Unit - 3

QUALITY OF WATER: Objectives of water quality management. wholesomeness & palatability, water borne diseases. Water quality parameters – Physical, chemical and Microbiological. Sampling of water for examination. Water quality analysis (BIS:10500) using analytical and instrumental techniques. Drinking water standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy

metals like Mercury, Cadmium, Arsenic etc.

6 Hours

Unit - 4

WATER TREATMENT: Objectives – Treatment flow-chart. Aeration-Principles, types of Aerators.

2

Hours

SEDIMENTATION: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test, chemical feeding, flash mixing, and clariflocculator.

4

Hours

Part - B

Unit - 5

FILTRATION: Mechanism – theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design – excluding under drainage system – back washing of filters. Operational problems in filters.

6 Hours

Unit - 6

DISINFECTION: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV irradiation treatment – treatment of swimming pool water

4

Hours

SOFTENING – definition, methods of removal of hardness by lime soda process and zeolite process RO & Membrane technique.

3 Hours

Unit - 7

MISCELLANEOUS TREATMENT: Removal of color, odor, taste, use of copper sulfate, adsorption technique, fluoridation and defluoridation.

4 Hours

DISTRIBUTION SYSTEMS: System of supply, service reservoirs and their capacity determination, methods of layout of distribution systems.

4

Hours

Unit - 8

MISCELLANEOUS: Pipe appurtenances, various valves, type of fire hydrants, pipefitting, Layout of water supply pipes in buildings.

2

Hours

TEXT BOOKS:

1. Water supply Engineering –S.K.Garg, Khanna Publishers
2. Environmental Engineering I –B C Punima and Ashok Jain
3. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi

REFERENCES

1. Hammer, M.J., (1986), **Water and Wastewater Technology** –SI Version, 2nd Edition, John Wiley and Sons.
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986),**Environmental Engineering**–Mc Graw Hill Book Co.
3. Raju, B.S.N., (1995), **Water Supply and Wastewater Engineering**, Tata McGraw Hill Pvt. Ltd., New Delhi.
4. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach**–Prentice Hall of India Pvt. Ltd., New Delhi.

DESIGN & DRAWING OF RC STRUCTURES

Subject Code	: 10CV62	IA Marks	: 25
No. of Lecture	: 02 (T) +03 (D)	Exam Hours	: 04
Hours/Week			
Total No. of Lecture	: 26 (T) + 39 (D)	Exam Marks	: 100
Hours			

PART - A

UNIT-1

Layout Drawing: General layout of building showing, position of columns, footings, beams and slabs with standard notations.

UNIT-2

Detailing of Beam and Slab floor system, continuous beams.

UNIT-3

Detailing of Staircases: Dog legged and Open well.

UNIT-4

Detailing of Column footings: Column and footing (Square and Rectangle).

13 (T) + 18 (D)

PART - B

UNIT-5

Design and detailing of Rectangular Combined footing slab and beam type.

UNIT-6

Design and detailing of Retaining walls (Cantilever and counter fort type).

UNIT-7

Design and detailing of Circular and Rectangular water tanks resting on ground and free at top (Flexible base and Rigid base), using IS: 3370 (Part IV) only.

UNIT-8

Design and detailing of Simple Portal Frames subjected to gravity loads. (Single bay & Single storey)

13 (T) + 21 (D)

REFERENCE BOOKS:

1. **Structural Design & Drawing Reinforced Concrete & Steel**- N. Krishnaraju, University Press.

2. **Structural Design and Drawing**- Krishnamurthy -, (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
3. **Reinforced Concrete Structures** - B.C. Punmia – Laxmi Publishing Co.
4. **Reinforced Concrete Design** – S.N.Sinha, McGrawHill Education,

SCHEME OF QUESTION PAPER:

Part A : Three questions each carrying 20 marks is to be set. Student has to answer two questions out of three.

Part B: Two questions each carrying 60 marks is to be set. Student has to answer one question out of two.

TRANSPORTATION ENGINEERING II

Subject Code	: 10CV63	
I A Marks	:25	
No. of lecture Hours/week	:04	
Exam Hours	:03	
Total No. of Lecture Hours	:52	
Exam Marks	:100	

PART – A **RAILWAY ENGINEERING**

UNIT – 1

INTRODUCTION: Role of railways in transportation, Indian Railways, Selection of Routes, Permanent way and its requirements, Gauges and types, Typical cross sections-single and double line B G track in cutting, embankment and electrified tracks, Coning of wheels and tilting of rails, **Rails**-Functions-requirements—types and sections-length-defects-wear-creep-welding-joints, creep of rails

06 Hrs

UNIT – 2

SLEEPERS AND BALLAST: Functions, requirements, Types, Track fitting and fasteners-Dog spike, screw spike and Pandrol clip,-Fish plates-bearing plates, Calculation of quantity of materials required for laying a track-Examples, **Tractive resistances** and hauling capacity with examples

06Hrs

UNIT – 3

GEOMETRIC DESIGN: Necessity, Safe speed on curves, **Cant**-cant deficiency-negative cant-safe speed based on various criteria,(both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above.

06 Hrs

UNIT – 4

POINTS AND CROSSING: Components of a turnout, Details of Points and Crossing, Design of turnouts with examples (No derivations) types of switches, crossings, track junctions and types-diamond and crossover, Stations and Types, Types of yards, Signalling-Objects and types of signals, station and yard Equipment-Turn table, Fouling mark, buffer stop, level crossing, track defects,

and maintenance. Traffic control system- Absolute and automatic Block systems.

08 Hrs

PART – B
AIRPORT ENGINEERING

UNIT – 5

INTRODUCTION: Layout of an airport with component parts and functions, Site selection for airport, Aircraft characteristics affecting the design and planning of airport, Airport classification, Runway orientation using wind rose with examples

06 Hrs

UNIT – 6

RUNWAY- Basic runway length-Corrections and examples, Runway geometrics, **Taxiway**-Factors affecting the layout - geometrics of taxiway-Design of exit taxiway with examples, **Visual aids-** Airport marking – lighting-Instrumental Landing System.

06 Hrs

TUNNEL ENGINEERING

UNIT – 7

TUNNELS: Advantages and disadvantages, Size and shape of tunnels, Surveying-Transferring centre line, and gradient from surface to inside the tunnel working face, Weisbach triangle-Examples, Tunnelling in rocks-methods, Tunnelling methods in soils-Needle beam method, Liner plate, Tunnel lining, Tunnel ventilation, vertical shafts, Pilot tunneling, mucking and methods, drilling and drilling pattern.

06Hrs

UNIT – 8

HARBOURS: Harbour classifications, Layout with components, Natural phenomenon affecting the design of harbour's - wind, wave and tide, currents, Breakwater-Types Wharf and Quays, Jetties and Piers, Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit-shed.

08 Hrs

TEXT BOOKS

1. **Railway Engineering** - Saxena and Arora, Dhanpat Rai & Sons, New Delhi
2. **Indian Railway Track** – M M Agarwal, Jaico Publications, Bombay

3. **Airport Planning and Design** – Khanna Arora and Jain, Nem Chand Bros, Roorkee
4. **Docks and Tunnel Engineering** – R Srinivasan, Charaotar Publishing House
5. **Docks and Harbour Engineering** –H P Oza and G H Oza Charaotar Publishing House
6. **Surveying** – B C Punmia, Laxmi Publications

REFERENCE BOOK

Railway Engineering – Mundrey, McGraw Hill Publications

GEOTECHNICAL ENGINEERING – II

Subject Code	: 10CV64	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

SUBSURFACE EXPLORATION: Importance of exploration program, Methods of exploration: Boring, Seismic refraction method of geophysical exploration, Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearance, Stabilisation of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

DRAINAGE AND DEWATERING: Determination of ground water level by Hvorslev's method, Control of ground water during excavation: Dewatering - Ditches and sumps, well point system, Vacuum method, Electro- Osmosis method.

8 Hours

UNIT - 2

STRESSES IN SOILS: Boussinesq's and Westergaard's theories for concentrated, circular and rectangular loads. Comparison of Boussinesq's and westergaard's analysis. Pressure distribution diagrams, Contact pressure, Newmark's chart.

Hours**UNIT - 3**

FLOWNETS: Laplace equation (no derivation) assumptions and limitations only, characteristics and uses of flownets, Methods of drawing flownets for Dams and sheet piles. Estimating quantity of seepage and Exit gradient. Determination of phreatic line in earth dams with and without filter. Piping and protective filter.

5 Hours**UNIT - 4**

LATERAL EARTH PRESSURE: Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories—assumptions and limitations, Graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.

7 Hours**PART - B****UNIT - 5**

STABILITY OF EARTH SLOPES: Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of infinite slopes, Stability of finite slopes by Method of slices and Friction Circle method, Taylor's stability number, Felineous method,.

7**Hours****UNIT - 6**

BEARING CAPACITY: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's and Brinch Hansen's bearing capacity equations - assumptions and limitations, Bearing capacity of footing subjected to eccentric loading. Effect of ground water table on bearing capacity. Field methods of evaluation of bearing capacity - Plate load test, Standard penetration test and cone penetration test.

8 Hours

UNIT - 7

FOUNDATION SETTLEMENT: Importance and Concept of Settlement Analysis, Immediate, Consolidation and Secondary settlements (no derivations, but, computation using relevant formula for Normally Consolidated soils), Tolerance. BIS specifications for total and differential settlements of footings and rafts.

5 Hours

UNIT – 8

PROPORTIONING SHALLOW AND PILE FOUNDATIONS

Allowable Bearing Pressure, Factors influencing the selection of depth of foundation, Factors influencing Allowable Bearing Pressure, Factors influencing the choice of foundation, Proportioning isolated, combined, strip and mat foundations, Classification of pile foundation, Pile load capacity, Proportioning pile foundation.

6

Hour
s

TEXT BOOKS:

1. **Soil Engineering in Theory and Practice-** Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.
2. **Soil Mechanics and Foundation Engg.-** Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi.

REFERENCES BOOKS:

1. **Foundation Analysis and Design-** Bowles J.E. (1996), 5th Edition, McGraw Hill Pub. Co. New York.
2. **Soil Mechanics and Foundation Engineering-** Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.
3. **Basic and Applied Soil Mechanics-** Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
4. **Geotechnical Engineering-** Venkatrahmaiah C. (2006), 3rd Edition New Age International (P) Ltd., New Delhi.
5. **Soil Mechanics-** Craig R.F. (1987), Van Nostrand Reinhold Co. Ltd.
6. **Principles of Geotechnical Engineering-** Braja M. Das (2009), 5th Edition, Cengage Learning (P) Ltd., India.

7. **Text Book of Geotechnical Engineering-** Iqbal H. Khan
(2005), 2nd Edition, PHI, India.

HYDRAULIC STRUCTURES & IRRIGATION DESIGN-DRAWING

Subject Code	: 10CV65	IA Marks	: 25
No. of Lecture Hours/Week	: 02+03	Exam Hours	: 04
Total No. of Lecture Hours	: 25+27	Exam Marks	: 100

PART-A

Hydraulic Structures

Unit1: Reservoir Planning

Introduction, classification of Reservoirs, Storage zones of a reservoir, Mass curve, fixing capacity of a reservoir, safe yield, problems, density currents, Trap efficiency, Reservoir sedimentation, life of a reservoir, economic height of a dam, problems. environmental effects of reservoirs, **6 hours**

Unit2: Gravity Dams

Introduction, forces on a gravity dam, stress analysis in gravity dam, Problems, combination of forces for design. Elementary & practical profiles of a gravity dam, stability analysis (without earth quake forces), problems, galleries in gravity dams,

7 hours

Unit3: Earth Dams

Introduction, types of Earth dams, construction methods, Design criteria for Earth dams, causes of failure of earth dams, section of dam, preliminary design criteria, problems, control of seepage through earth dams, Safety measures.

6 hours

Unit4: Spillways

Introduction, essentials of a spillway, spillway components, factors affecting type & design of spillways. Ogee spillway (simple design problems). Energy dissipation below spillways (hydraulic jump- No design). **6 hours**

PART-B

Irrigation Design- Drawing

Design and Drawing with all the three views of :

1. Surplus weir with stepped apron
2. Canal gate sluice without tower head
3. Notch type Canal Drop

4. Canal Cross regulator.
5. Simple Aqeduct of Type III(Hydraulic Design only)

27 hours

Text Books:

1. Irrigation engineering & Hydraulic structures- Garg.S.K., khanna publishers, New Delhi
2. Irrigation & Water resources engineering- G.L.Asawa, New Age International Publishers, New Delhi (2005)
3. Irrigation, Water Resources & Water power engineering- Modi . P.N., Standard Book House, New Delhi
4. Design of minor irrigation and Canal structures- C. Sathya Narayana Murthy, Wiley eastern limited, New Delhi (1990)

Reference Books:

1. Text book of irrigation engineering & Hydraulic Structures- R.K.Sharma, Oxford & IBH publishing Co., New Delhi (2002)
2. Hydraulic Structures & Irrigation Design Drawing - Dr.N.Balasubramanya, Tata Mcgraw-Hill Education Pvt.Ltd., New Delhi
3. Irrigation and Water Power Engineering- Madan Mohan Das & Mimi Das Saikia, PHI Learning Pvt. Ltd., New Delhi (2009)

Question paper pattern:

Four questions are to be set from Part A of which **Two** full questions are to be answered for 40 marks

Two questions are to be set from Part B of which **one** full question is to be answered for 60 marks (25 marks for design + 35 marks for two views)

GROUND IMPROVEMENT TECHNIQUES

Subject Code	: 10CV663	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

GROUND IMPROVEMENT: Definition, Objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Ground modification for Black Cotton soil

4

Hours

UNIT - 2

COMPACTION: Effect of grain size distribution on compaction for various soil types like lateritic soil, coarse-grained soil and micaceous soil. Effect of compaction on engineering behaviour like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type. Specification of compaction. Tolerance of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation.

8 Hours

UNIT - 3

HYDRAULIC MODIFICATION: Definition, Principle and techniques. gravity drain, lowering of water table, multistage well point, vacuum dewatering. Discharge equations. Design of dewatering system including pipe line effects of dewatering.

6

Hours

UNIT - 4

DRAINAGE & PRELOADING: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

6

Hours

PART - B

UNIT - 5

CHEMICAL MODIFICATION-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.

6

Hours

UNIT - 6

CHEMICAL MODIFICATION-II: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

6

Hours

UNIT - 7

GROUTING: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

6

Hours

UNIT - 8

MISCELLANEOUS METHODS (ONLY CONCEPTS & USES): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micropiles.

8

Hours

TEXT BOOKS:

1. **Ground Improvement Techniques-** Purushothama Raj P. (1999) Laxmi Publications, New Delhi.
2. **Construction and Geotechnical Method in Foundation Engineering-** Koerner R.M. (1985) - Mc Graw Hill Pub. Co., New York.

REFERENCE BOOKS:

1. **Engineering principles of ground modification-** Manfred Hausmann (1990) - Mc Graw Hill Pub. Co., New York.
2. **Methods of treatment of unstable ground-** Bell, F.G. (1975) Butterworths, London.

3. **Expansive soils-** Nelson J.D. and Miller D.J. (1992) -, John Wiley and Sons.
4. **Soil Stabilization; Principles and Practice-** Ingles. C.G. and Metcalf J.B. (1972) - Butterworths, London.

RURAL WATER SUPPLY AND SANITATION

Subject Code	:10CV666	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

Part - A

UNIT - 1

RURAL WATER SUPPLY: Introduction: Need for a protected water supply, investigation and selection of water sources, water borne diseases, protection of well water, drinking water quality standards.

6

Hours

UNIT - 2

Types of pumps, supply systems viz., BWS MWS, PWS, water treatment methods – disinfection, defluoridation, hardness and iron removal, ground water contamination and control.

6

Hours

UNIT - 3

RURAL SANITATION: public latrine, concept of Eco-sanitation, trenching and composting methods, Two pit latrines, aqua privy, W.C, septic tank, soak pit.

8

Hours

UNIT - 4

DRAINAGE SYSTEMS: Storm water and sullage disposal, rain water harvesting and uses.

3

Hours

Part - B

UNIT - 5

COMMUNICABLE DISEASES: Terminology, classifications, methods of communication, general methods of control.

4 Hours

UNIT - 6

REFUSE COLLECTION AND DISPOSAL: collection methods, transportation, disposal – salvaging, dumping, manure pits, dumping

in low lands , composting, dung disposal – digester, biogas plant.

10

Hours

UNIT - 7

MILK SANITATION: Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed.

9

Hours

UNIT - 8

INSECT CONTROL: House fly and mosquito – life cycle, diseases, transmission and control measures.

6

Hours

TEXT BOOKS:

1. Environmental Sanitation - Joseph. A. Solveto
2. Water Supply & Sanitary Engineering - E.W.Steel

REFERENCE BOOK:

1. Preventive & Social Medicine - Park & Park

GEOTECHNICAL ENGINEERING LABORATORY

Subject Code	: 10CVL67	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. Identification of gravel type, sand type, silt type and clay types soils,

3 Hours
2. Tests for determination of Specific gravity (for coarse and fine grained soils) and Water content (Oven drying method).

3 Hours
3. Grain size analysis of soil sample (sieve analysis).

3 Hours
4. In situ density by core cutter and sand replacement methods.

3 Hours
5. Consistency Limits – Liquid Limit (Casagrande and Cone Penetration Methods), plastic limit and shrinkage limit.

6 Hours
6. Standard Proctor Compaction Test and Modified Proctor Compaction Test.

3 Hours
7. Coefficient of permeability by constant head and variable head methods.

3 Hours
8. Strength Tests
 - a. Unconfined Compression Test **3 Hours**
 - b. Direct Shear Test **3 Hours**
 - c. Triaxial Compression Test (undrained) **3 Hours**
9. Consolidation Test- Determination of compression index and coefficient of consolidation.

3 Hours
10. Laboratory vane shear test **3 Hours**

11. a) Demonstration of miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.
- b) Demonstration of Hydrometer Test.
- c) Demonstration of Free Swell Index and Swell Pressure Test
- d) Demonstration of determination of relative density of sands.

3 Hours

12. Preparing a consolidated report of index properties and strength properties of soil

3 Hours

REFERENCE BOOKS:

1. **Soil Mechanics and Foundation Engg-** Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi.
2. **BIS Codes of Practice:** IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1966, IS 2720 (Part-60) 1965.
3. **Mittal**
4. **Soil Testing for Engineers-** Lambe T.W., Wiley Eastern Ltd., New Delhi.
5. **Manual of Soil Laboratory Testing-** Head K.H., (1986)- Vol. I, II, III, Princeton Press, London.
6. **Engineering Properties of Soil and Their Measurements-** Bowles J.E. (1988), - McGraw Hill Book Co. New York.

EXTENSIVE SURVEY VIVA - VOCE

Subject Code	: 10CVL68	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

(To be conducted between 5th & 6th Semester for a period of 2 weeks, Viva voce conducted along with 6th semester exams)

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days). The student shall submit a project report consisting of designs and drawings. **(Drawings should be done using AutoCAD)**

1. General instructions, Reconnaissance of the sites and fly leveling to establish bench marks.
2. **NEW TANK PROJECTS:** The work shall consist of
 - i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
 - ii) Capacity surveys.
 - iii) Details at Waste weir and sluice points.
 - iv) Canal alignment.**(At least one of the above new tank projects should be done by using TOTAL STATION)**
3. **WATER SUPPLY AND SANITARY PROJECT:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.
4. **HIGHWAY PROJECT:** Preliminary and detailed investigations to align a new road (min. 1 to max 2.0 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross

sections of road. **(The Highway project should be done by using TOTAL STATION)**

5. **OLD TANK PROJECTS:** The work shall consist of
 - i) Alignment of center line of the existing bund, Longitudinal and cross sections of the centre line.
 - ii) Capacity surveys to explore the quantity.
 - iii) Details at existing Waste weir and sluice points.

**VII SEMESTER
ENVIRONMENTAL ENGINEERING – II**

Subject Code	: 10CV71	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Necessity for sanitation, methods of domestic waste water disposal, types of sewerage systems and their suitability.

Dry weather flow, factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow, estimation of storm flow, rational method and empirical formulae of design of storm water drain. Time of concentration.

6 Hours

UNIT - 2

DESIGN OF SEWERS: Hydraulic formulae for velocity, effects of flow variations on velocity, self cleansing and non scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full (No derivations).

MATERIALS OF SEWERS: Sewer materials, shapes of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

6 Hours

UNIT - 3

SEWER APPURTENANCES: Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage.

6 Hours

UNIT - 4

WASTE WATER CHARACTERIZATION: Sampling, significance, techniques and frequency. Physical, Chemical and Biological characteristics, Aerobic and Anaerobic activity, CNS cycles. BOD and COD. Their significance & problems

06 Hours

PART – B

UNIT - 5

DISPOSAL OF EFFLUENTS : Disposal of Effluents by dilution, self-purification phenomenon. Oxygen sag curve, Zones of purification, Sewage farming, sewage sickness, Effluent Disposal standards for land, surface water & ocean. Numerical Problems on Disposal of Effluents. Streeter Phelps equation.

6 Hours

UNIT - 6

TREATMENT OF WASTE WATER: Flow diagram of municipal waste water treatment plant. Preliminary & Primary treatment : Screening, grit chambers, skimming tanks, primary sedimentation tanks – Design criteria & Design examples.

6 Hours

UNIT - 7

SECONDARY TREATMENT: Suspended growth and fixed film bioprocess. Trickling filter – theory and operation, types and designs. Activated sludge process- Principle and flow diagram, Modifications of ASP, F/M ratio. Design of ASP.

8 Hours

UNIT - 8

Anaerobic Sludge digestion, Sludge digestion tanks, Design of Sludge drying beds. Low cost waste treatment method. Septic tank, Oxidation Pond and Oxidation ditches – Design. Reuse and recycle of waste water.

8 Hours

REFERENCES

1. **Manual on Waste Water Treatment** : CPHEEO, Ministry of Urban Development, New Delhi.
2. **Water and Wastewater Engineering Vol-II** :- Fair, Geyer and Okun : John Willey Publishers, New York.
3. **Waste Water Treatment, Disposal and Reuse** : Metcalf and Eddy inc : Tata McGraw Hill Publications.
4. **Water Technology**.- Hammer and Hammer
5. **Environmental Engineering**: Howard S. Peavy, Donald R. Rowe, George Tchnobanoglous McGraw Hill International Edition.

DESIGN OF STEEL STRUCTURES

Subject Code	: 10CV72	IA Marks	25
No. of Lecture Hours/Week	: 04	Exam Hours	03
Total No. of Lecture Hours	: 52	Exam Marks	100

PART-A

UNIT-1

INTRODUCTION: Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications and section classification. **6 Hours**

UNIT-2

BOLTED CONNECTIONS: Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Simple framed connections, Moment resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections **7 Hours**

UNIT-3

WELDED CONNECTIONS: Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices, Tubular connections **7 Hours**

UNIT-4

Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse, Methods of Plastic analysis. **5 Hours**

PART-B

UNIT-5

Design of Tension Members: Introduction, Types of tension members, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. **6 Hours**

UNIT-6

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members. **8 Hours**

UNIT-7

Design of Column Bases:, Design of simple slab base and gusseted base **6 Hours**

UNIT-8

Design of Beams: Introduction, Beam types, , Lateral stability of beams, factors affecting lateral stability, Behaviour of simple and built-up beams in bending(without vertical stiffeners), Design strength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins
7 Hours

Note: Study of this course should be based on **IS: 800-2007**

Reference Books

- 1) **Design of Steel Structures**, N.Subramanian, Oxford, 2008
 2. Limit State Design of Steel Structures. Duggal. TATA Megra Hill 2010
 - 3) Bureau of Indian Standards, IS800-2007, IS875-1987
 - 4) Design of Steel Structures, William T.Segui, India Edition, Cengage Learning.
- 4) Steel Tables**

ESTIMATION & VALUATION

Subject Code	: 10CV73	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

ESTIMATION: Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost – center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, sloped RCC roofs with all Building components.

16 Hours

PART - B

ESTIMATE: Different type of estimates, approximate methods of estimating buildings, cost of materials. Estimation of wooden joineries such as doors, windows & ventilators.

5 Hours

ESTIMATES: Steel truss (Fink and Howe truss), manhole and septic tanks, RCC Culverts.

6 Hours

SPECIFICATIONS: Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.

5 Hours

PART - C

RATE ANALYSIS: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

6 Hours

MEASUREMENT OF EARTHWORK FOR ROADS: Methods for computation of earthwork – cross sections – mid section formula or average end area or mean sectional area, trapezoidal & prismatic formula with and without cross slopes.

6 Hours

CONTRACTS: Types of contract – essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Valuation- Definitions of various terms, method of valuation, Freehold & Leasehold properties, Sinking fund, depreciation and method of estimating depreciation, Outgoings.

8 Hours

REFERENCE BOOKS:

1. **Estimating & Costing**, B. N. Dutta, Chand Publisher
2. **Quantity Surveying**- P.L. Basin S. Chand : New Delhi.
3. **Estimating & Specification** - S.C. Rangwala :: Charotar publishing house, Anand.
4. **Text book of Estimating & Costing**- G.S. Birde, Dhanpath Rai and sons : New Delhi.
5. **A text book on Estimating, Costing and Accounts**- D.D. Kohli and R.C. Kohli S. Chand : New Delhi.
6. **Contracts and Estimates**, B. S. Patil, University Press, 2006.

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

Subject Code	: 10CV74	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

MATERIALS: High strength concrete and steel, Stress-Strain characteristics and properties.

2 Hours

BASIC PRINCIPLES OF PRESTRESSING: Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages.

4 Hours

UNIT - 2

ANALYSIS OF SECTIONS FOR FLEXURE: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles.

8 Hours

UNIT - 3

LOSSES OF PRE-STRESS: Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.

6 Hours

UNIT - 4

DEFLECTIONS: Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection

6 Hours

PART - B

UNIT - 5

LIMIT STATE OF COLLAPSE: Flexure -IS Code recommendations – Ultimate flexural strength of sections.

5 Hours

UNIT - 6

LIMIT STATE OF COLLAPSE (cont...): Shear - IS Code recommendations, shear resistance of sections, shear reinforcement. Limit state of serviceability – control of deflections and cracking.

7 Hours

UNIT - 7

DESIGN OF END BLOCKS: Transmission of prestress in pretensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, I.S. Code, provision for the design of end block reinforcement.

6 Hours

UNIT - 8

DESIGN OF BEAMS: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of prestressing force and eccentricity, limiting zone of pre-stressing force cable profile.

8 Hours**REFERENCE BOOKS:**

1. **Pre-stressed Concrete-** N. Krishna Raju - Tata Mc. Graw Publishers.
2. **Pre-stressed Concrete-** P. Dayarathnam : Oxford and IBH Publishing Co.
3. **Design of pre-stressed concrete structures-** T.Y. Lin and Ned H. Burns - John Wiley & Sons, New York.
4. **Fundamental of pre-stressed concrete-** N.C. Sinha & S.K. Roy
5. IS : 1343 : 1980
6. **Pre-stressed Concrete-** N. Rajgopalan

SOLID WASTE MANAGEMENT

Subject Code	10CV757	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A

UNIT - 1

INTRODUCTION: Definition, Land Pollution – scope and importance of solid waste management, functional elements of solid waste management.

SOURCES: Classification and characteristics – municipal, commercial & industrial. Methods of quantification.

08 Hours

UNIT - 2

COLLECTION AND TRANSPORTATION: Systems of collection, collection equipment, garbage chutes, transfer stations – bailing and compacting, route optimization techniques and problems.

06 Hours

UNIT - 3

TREATMENT / PROCESSING TECHNIQUES: Components separation, volume reduction, size reduction, chemical reduction and biological processing problems.

6 Hours

UNIT - 4

INCINERATION: Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolysis, design criteria for incineration.

6 Hours

PART - B

UNIT - 5

COMPOSTING: Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.

6 Hours

UNIT - 6

SANITARY LAND FILLING: Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary land fills.

8 Hours

UNIT - 7

DISPOSAL METHODS: Open dumping – selection of site, ocean disposal, feeding to hogs, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, biomedical wastes and disposal.

6 Hours

UNIT - 8

RECYCLE AND REUSE: Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

5 Hours

REFERENCES

1. **Integrated Solid Waste Management:** Tchobanoglous : M/c Graw Hill.
2. **Solid Waste Management in developing countries.** Bhide and Sunderashan
3. **Hand book on Solid Waste Disposal.:** Pavoni J.L.
4. **Environmental Engineering.:** Peavy and Tchobanoglous
5. **Environmental Engineering – Vol II:** S.K. Garg
6. **Biomedical waste handling rules – 2000.**
7. **Solid Waste Engineering by** Vesilind.Pa Worrell & Reinhart.D. – 2009, Cengage Learning India Private Limited, New Delhi.

PAVEMENT MATERIALS AND CONSTRUCTION

Subject Code	: 10CV763	IA Marks	25
No. of Lecture Hours/Week	: 04	Exam Hours	03
Total No. of Lecture Hours	: 52	Exam Marks	100

PART - A

PAVEMENT MATERIALS

UNIT - 1

AGGREGATES: Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

6 Hours

UNIT - 2

BITUMEN AND TAR: Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

4 Hours

UNIT - 3

BITUMINOUS EMULSIONS AND CUTBACKS: Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.

8 Hours

UNIT - 4

BITUMINOUS MIXES: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (no Hveem Stabilometer & Hubbar – Field

Tests) bituminous mix, design methods using Rotchfutch's Method only and specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.

6 Hours

PART - B

PAVEMENT CONSTRUCTION

UNIT - 5

EQUIPMENT IN HIGHWAY CONSTRUCTION: Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

6 Hours

UNIT - 6

SUBGRADE: Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

6 Hours

UNIT - 7

FLEXIBLE PAVEMENTS: Specifications of materials, construction method and field control checks for various types of flexible pavement layers.

8 Hours

UNIT - 8

CEMENT CONCRETE PAVEMENTS: Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.

8 Hours

TEXT BOOKS:

1. **Highway Engineering-** Khanna, S.K., and Justo, C.E.G., : Nem Chand and Bros. Roorkee
2. **Construction Equipment and its Management-** Sharma, S.C. : Khanna Publishers.
3. **Hot Mix Asphalt Materials, Mixture Design and Construction-** Freddy L. Roberts, Kandhal, P.S. : University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

REFERENCES BOOKS:

1. RRL, DSIR, „**Bituminous Materials in Road Construction**“, HMSO Publication.
2. RRL, DSIR, „**Soil Mechanics for Road Engineers**“, HMSO Publication.
3. Relevant IRC codes and MoRT & H specifications

ENVIRONMENTAL ENGINEERING LABORATORY

Subject Code	10CVL77	IA Marks	: 25
No. of Practical Hours/Week	: 03	Exam Hours	: 03
Total No. of Practical Hours	: 42	Exam Marks	: 50

1. Determination of Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, Volatile Solids, Fixed Solids, Settleable Solids.
2. Electrical conductivity. Determination of Chlorides and Sulphates.
3. Determination of Alkalinity, Acidity and pH.
4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen. Determination of BOD.
6. Determination of COD.
7. Determination of percentage of available chlorine in bleaching powder, Residual Chlorine and Chlorine Demand.
8. Jar Test for Optimum Dosage of Alum, Turbidity determination by Nephelometer.

9. Determination of Iron. Phenanthroline method.
10. Determination of Fluorides SPANDS Method.
11. MPN Determination
12. Determination Nitrates by spectrophotometer.
13. Determination of sodium and potassium by flame photometer.

REFERENCES

1. **Manual of Water and Wastewater Analysis** – NEERI Publication.
2. **Standard Methods for Examination of Water and Wastewater** (1995), American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. **IS Standards** : 2490-1974, 3360-1974, 3307-1974.
4. **Chemistry for Environment Engineering**, Sawyer and Mc Carthy,

CONCRETE AND HIGHWAY MATERIALS LABORATORY

Subject Code	: 10CVL78	IA Marks	25
No. of Practical Hours/Week	: 03	Exam Hours	03
Total No. of Practical Hours	: 42	Exam Marks	50

PART - A

CEMENT: Normal Consistency, Setting time, Soundness by Autoclave method, Compression strength test and Air permeability test for fineness, Specific gravity of cement.

FRESH CONCRETE : Workability – slump, Compaction factor and Vee Bee tests.

HARDENED CONCRETE : Compression strength and Split tensile tests. Test on flexural strength of RCC beams, Permeability of concrete.

PART - B

SOIL: CBR Test.

AGGREGATES: Crushing, Abrasion (Los Angeles Abrasion), Impact and Shape tests (Flaky, Elongation, Angularity number) Specific gravity and Water Absorption.

BITUMINOUS MATERIALS AND MIXES: Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity, proportioning of aggregate mixes by Rotchfutch Method, Marshall Stability tests. Water Sensitivity test on Compacted Bituminous mixes.

REFERENCE BOOK:

1. Relevant IS Codes and IRC Codes.
2. **Highway Material Testing Laboratory Manual** by Khanna S K and Justo, – CEG Nemi Chand & Bros.
3. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi.

ADVANCED CONCRETE TECHNOLOGY

Subject Code	: 10CV81	IA Marks	: 25
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

7 Hour**UNIT - 2**

CHEMICAL ADMIXTURES- Mechanism of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation superplasticiser.

MINERAL ADMIXTURE-Fly ash, Silica fume, GGBS, and their effect on concrete property in fresh state and hardened state.

6 Hours**UNIT - 3**

MIX DESIGN - Factors affecting mix design, design of concrete mix by BIS method using IS10262-2009, current American (ACI)/ British (BS) methods. Problems as per provisions in IS10262-2009.

6 Hours**UNIT - 4**

DURABILITY OF CONCRETE - Introduction, Permeability of concrete, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability.

7 Hours**PART - B****UNIT - 5**

Ready mixed concrete - manufacturing, transporting, placing, precautions.

Methods of concreting- Pumping, under water concreting, shotcrete.
High volume fly ash concrete concept, properties, typical mix
Self compacting concrete concept, materials, tests, properties, application and
Typical mix.

6 Hours

UNIT - 6

Fibre reinforced concrete - Fibers types and properties, Behavior of FRC in
compression, tension including pre-cracking stage and post-cracking stages,
behavior in flexure and shear.

Ferro cement - materials, techniques of manufacture, properties and
applications.

7 Hours

UNIT - 7

Light weight concrete-materials properties and types. Typical light weight
concrete mix.

High density concrete and high performance concrete-materials, properties
and applications, typical mix.

6 Hours

UNIT - 8

Tests on Hardened concrete-Effect of end condition of specimen, capping,
H/D ratio, rate of loading, moisture condition. Compression, tension and
flexure tests. Tests on composition of hardened concrete-cement content,
original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity
methods.

7 Hours

TEXT / REFERENCE BOOKS:

1. **Properties of Concrete**- Neville, A.M. - ELBS Edition, Longman Ltd., London
2. **Concrete Technology**- M.S. Shetty, S.Chandand Company, New Delhi, 2002.
3. **Concrete Technology**- A.R. Santhakumar,-Oxford University Press.
4. **Concrete**- P.K. Mehta, P J M Monteiro,- Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute Chennai)
5. IS 10262-2009 and IS 456-2000
6. ACI Code for Mix Design
7. **Concrete Mix Design**- N. Krishna Raju - Sehgal Publishers
8. **Concrete Technology** – M.L.Gambhir, TATA McGRAW HILL, New Delhi.
9. **Advanced Concrete Technology Processes**- John Newman, Ban Seng Choo, - London.
10. **Advanced Concrete Technology Constituent materials**- John Newman, Ban Seng Choo- London

11. **Non-Destructive Test and Evaluation of Materials-** J.Prasad, C G K Nair,-Mc Graw Hill.
12. **High Performance Concrete-** Prof Aitcin P C- E and FN, London.
13. **Properties of Fresh Concrete-** Power T.C.- E and FN, London.

DESIGN AND DRAWING OF STEEL STRUCTURES

Subject Code	:10CV82	IA Marks	: 25
No. of Lecture Hours/Week	: 02 (T) + 3 (D)	Exam Hours	: 04
Total No. of Lecture Hours	: 26 (T) + 39 (D)	Exam Marks	: 100

PART - A

(DRAWINGS TO BE PREPARED FOR GIVEN STRUCTURAL DETAILS)

UNIT - 1

CONNECTIONS: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

UNIT - 2

COLUMNS: Splices, Column-column of same and different sections. Lacing and battens.

UNIT - 3

COLUMN BASES: Slab base and gusseted base.

08 (T) + 15 (D)

PART - B

UNIT - 4

Design and drawing of

- i) Bolted or welded plate girder
- ii) Roof Truss (Forces in the members to be given)
- iii) Gantry girder

18 (T) + 24 (D)

Note :

- i. In part A, Two questions to be set, out of which one question to be answered (30% weightage).
- ii. In part B, Two questions to be set, out of which one question to be answered (70% weightage).

TEXT / REFERENCE BOOKS:

1. **Structural Design & Drawing** – N.Krishna Raju, Universities Press, India.
2. **Design of Steel Structures** - N. Subramanian : Oxford University, Press.
3. **Design of Steel Structures** - Negi - Tata Mc Graw Hill Publishers.

4. **Design of Steel Structures** - Arya and Ajaman- Nem Chand & Bros. Roorkee.
5. **Design of Steel Structures.**- Raghupati
6. IS : 800 – 2007,
7. SP 6 (1) – 1984 or Steel Table.

ADVANCED FOUNDATION DESIGN

Subject Code : **10CV832** IA Marks : 25

No. of Lecture Hours/Week : 04 Exam Hours : 03

Total No. of Lecture Hours : 52 Exam Marks : 100

PART - A

UNIT - 1

BEARING CAPACITY & SETTLEMENT: Presumptive bearing capacity according to BIS, Factors affecting bearing capacity, Factors influencing selection of depth of foundation, types of shallow foundations, Settlement of Shallow Foundations: Immediate, consolidation, & differential settlements, Factors influencing settlement, Safe Bearing Capacity and Allowable Bearing Pressure.

6 Hours

UNIT - 2

SHALLOW FOUNDATIONS: Principles of Design of foundation, Definition for Shallow and Deep foundation, Requirements for geotechnical and structural aspects of design, Proportioning of isolated footing, combined footing, Strap footing, Strip footing and Raft foundation.

6 Hours

UNIT - 3

PILE FOUNDATIONS – SINGLE PILE: Historical Development, Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests, Laterally Loaded Pile.

6 Hours

UNIT - 4

PILE FOUNDATIONS – GROUP EFFECT: Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, Under reamed piles.

7 Hours

PART - B

UNIT - 5

WELL FOUNDATIONS: Historical Development, Different shapes and characteristics of wells, Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies for tilts and shifts.

6 Hours

UNIT - 6

DRILLED PIERS & CAISSONS: Construction, advantages and disadvantages of drilled piers. Design concepts and Advantages and disadvantages of open, pneumatic and floating caissons.

7 Hours

UNIT - 7

FOUNDATIONS ON EXPANSIVE SOILS: Definition, Identification, Mineral Structure, Index properties of expansive soils, Swell potential and

Swell pressure, Free swell, Tests on expansive soils, foundation treatment for structures in expansive soil, CNS layer.

6 Hours

UNIT - 8

MACHINE FOUNDATIONS: Basic definitions in vibration, free and forced vibrations, determination of natural frequency, types of Machine foundations, general criteria for design of machine foundation.,vibration analysis of a machine foundation, degrees of freedom of a block foundation, vibration isolation and control,

8 Hours

TEXT BOOKS:

1. **Soil Mechanics & Foundation Engineering** - V.N.S. Murthy - Pub: Sai Tech.
2. **Foundation Engineering** - Braja M. Das – Cengage Learning.
3. **Soil Mechanics Foundations** - Dr. B.C. Punmia - Pub : Laxmi publications, pvt. Ltd.

REFERENCE BOOKS:

1. **Foundation Analysis and Design** - Bowles J.E. (1996) - 5th Ed, McGraw Hill Pub. Co., New York.
2. **Advanced Foundation Engineering** - V.N.S. Murthy - Pub : Sai Tech.
3. **Pile Foundation**.- Chellies
4. **Geotechnical Engineering**.- P. Purushotham Raj
5. **Geotechnical Engineering** - Dr. C. Venkataramaiah - Pub : New age Publications.

6. **Foundation Engineering** - Dr. P.C. Varghese :- Pub : Prentice Hall of India.

REINFORCED EARTH STRUCTURES

Subject Code : **10CV842**

IA Marks : 25

No. of Lecture Hours/Week : 04 Exam Hours : 03

Total No. of Lecture Hours : 52 Exam Marks : 100

PART - A

UNIT- 1

BASICS OF REINFORCED EARTH CONSTRUCTION: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

06 Hours

UNIT- 2

GEOSYNTHETICS AND THEIR FUNCTIONS

Historical developments, Recent developments, manufacturing process-woven & non-woven, Raw materials – polypropylene (polyolefin), Polyethylene (Polyolefin), Polyester, Polyvinyl chloride, Elastomers, Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics – Geotextiles, Geogrids, Geomembranes, Geocomposites, Geonets, Geofabric, Geomats, Geomeshes, Geoweb etc.

06 Hours

UNIT- 3

PROPERTIES AND TESTS ON MATERIALS

Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties

07 Hours

UNIT - 4

DESIGN OF REINFORCED EARTH RETAINING WALLS

Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, typical design problems

07 Hours

PART-B

UNIT- 5

DESIGN OF REINFORCED EARTH FOUNDATIONS AND EMBANKMENTS

Foundations - Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.

Embankments - Concept of Reinforced Embankments, Internal and external stability, Selection of materials, typical design problems

07 Hours

UNIT - 6

SOIL NAILING TECHNIQUES

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

06 Hours

UNIT- 7

GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS:

Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability.

Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps

07 Hours

UNIT- 8

GEOSYNTHETICS FOR ROADS AND SLOPES

Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements

Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.

06 Hours

TEXT BOOKS:

1. **Design with geosynthetics-** Koerner. R.M. - Prince Hall Publication, 2005.
2. **Construction and Geotechnical Engineering using synthetic fabrics-** Koerner. R.M. & Wesh, J.P.- Wiley Inter Science, New York, 1980.
3. **An introduction to Soil Reinforcement and Geosynthetics –** Sivakumar Babu G. L., Universities Press, Hyderabad, 2006
4. **Reinforced Soil and its Engineering Applications, Swami Saran,** I. K. International Pvt. Ltd, New Delhi, 2006
5. **Engineering with Geosynthetics-** Venkattappa Rao, G., & Suryanarayana Raju., G. V.S. - Tata Mc Graw Hill publishing Company Limited., New Delhi.

REFERENCE BOOKS:

1. **Earth reinforcement and Soil structure-** Jones CJEPButterworths, London, 1996.
2. **Geotextile Hand Book-** Ingold, T.S. & Millar, K.S. - Thomas, Telford, London.
3. **Earth Reinforcement Practices -** Hidetoshi Octial, Shigenori Hayshi & Jen Otani -Vol. I, A.A. Balkema, Rotterdam, 1992.
4. **Ground Engineer"s reference Book-** Bell F.G. - Butterworths, London, 1987.
5. **Reinforced Earth-** Ingold, T.S. - Thomas, Telford, London.
6. **Geosynthetics in Civil Engineering,** Editor Sarsby R W, Woodhead Publishing Ltd & CRC Press, 2007

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(Common to _____)

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours / Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics – III	04		03	80	20	100	4
2	15CV32	Strength of Materials	04		03	80	20	100	4
3	15CV33	Fluid Mechanics	04		03	80	20	100	4
4	15CV34	Basic Surveying	04		03	80	20	100	4
5	15CV35	Engineering Geology	04		03	80	20	100	4
6	15CV36	Building Materials and Construction	04		03	80	20	100	4
7	15CVL37	Building Materials Testing Laboratory		1I+2P	03	80	20	100	2
8	15CVL38	Basic Surveying Practice		1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note:

<i>Core Subjects:</i>	<i>15CV31, 15CV32, 15CV33, 15CV34, 15CV35, 15CV36</i>
<i>Laboratory & Practice:</i>	<i>15CVL37, 15CVL38</i>

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(Common to _____)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours / Week		Examination				Credits
			Theory	Practical / Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics – IV	04		03	80	20	100	4
2	15CV42	Analysis of Determinate Structures	04		03	80	20	100	4
3	15CV43	Applied Hydraulics	04		03	80	20	100	4
4	15CV 44	Concrete Technology	04		03	80	20	100	4
5	15CV45	Basic Geotechnical Engineering	04		03	80	20	100	4
6	15CV46	Advanced Surveying	04		03	80	20	100	4
7	15CVL47	Fluid Mechanics Laboratory		1I+2P	03	80	20	100	2
8	15CVL48	Engineering Geology Laboratory		1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note:

<i>Core Subjects:</i>	<i>15CV 41, 15CV42, 15CV43, 15CV 44, 15CV45, 15CV46</i>
<i>Laboratory & Practice:</i>	<i>15CVL47, 15CVL48</i>

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B.E. CIVIL ENGINEERING

V SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CV51	Design of RC Structural Elements	04		03	80	20	100	4
2	15CV52	Analysis of Indeterminate Structures	04		03	80	20	100	4
3	15CV53	Applied Geotechnical Engineering	04		03	80	20	100	4
4	15CV54	Computer Aided Building Planning and Drawing	01	3D	03	80	20	100	4
5	15CV55X	Professional Elective-1	03		03	80	20	100	3
6	15CV56X	Open Elective-1	03		03	80	20	100	3
7	15CVL57	Geotechnical Engineering Laboratory		1I+2P	03	80	20	100	2
8	15CVL58	Concrete and Highway Materials Laboratory		1I+2P	03	80	20	100	2
TOTAL			19	09	24	640	160	800	26

Professional Elective 1		Open Elective 1	
15CV552	Railways, Harbours, tunneling and Airports	15CV563	Remote Sensing and GIS

1. **Professional Elective:** Elective relevant to chosen specialization/ branch
2. **Open Elective:** Electives from other technical and/or emerging subject areas

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B.E. CIVIL ENGINEERING

VI SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CV61	Construction Management and Entrepreneurship	04		03	80	20	100	4
2	15CV62	Design of Steel Structural Elements	04		03	80	20	100	4
3	15CV63	Highway Engineering	04		03	80	20	100	4
4	15CV64	Water Supply and Treatment Engineering	04		03	80	20	100	4
5	15CV65X	Professional Elective 2	03		03	80	20	100	3
6	15CV66X	Open Elective 2	03		03	80	20	100	3
7	15CVL67	Software Application Lab		1I+2P	03	80	20	100	2
8	15CVP68	Extensive Survey Project /Camp		1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective-2		Open Elective-2	
15CV651	Solid Waste Management	15CV661	Water Resource Management

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B.E. CIVIL ENGINEERING

VII SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CV71	Municipal and Industrial Waste Water Engineering	04		03	20	80	100	4
2	15CV72	Design of RCC and Steel Structures	04		03	20	80	100	4
3	15CV73	Hydrology and Irrigation Engineering	04		03	20	80	100	4
4	15CV74X	Professional Elective 3	03		03	20	80	100	3
5	15CV75X	Professional Elective 4	03		03	20	80	100	3
6	15CVL76	Environmental Engineering Laboratory		1I+2P	03	20	80	100	2
7	15CVL77	Computer Aided Detailing of Structures		1I+2D	03	20	80	100	2
8	15CVP78	Project Phase I +Project Seminar		3		100		100	2
TOTAL			18	9	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CV742	Ground Water & Hydraulics	15CV753	Rehabilitation and Retrofitting of Structures

1. Project Phase-I + Seminar: Literature Survey, Problem Identification, objectives and Methodology, Submission of synopsis and seminar

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VIII SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CV81	Quantity Surveying and Contracts Management	4	-	3	20	80	100	4
2	15CV82	Design of Pre Stressed Concrete Elements	4	-	3	20	80	100	4
3	15CV83X	Professional Elective 5	3	-	3	20	80	100	3
4	15CV84	Internship/Professional Practice	Industry Oriented		3	50	50	100	2
5	15CVP85	Project Work	-	6	3	100	100	200	6
6	15CVS86	Seminar on current trends in Engineering and Technology	-	4	-	100	-	100	1
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CV833	Pavement Design

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. CIVIL ENGINEERING

(Common to _____)

III SEMESTER

Sl. No	Subject Code	Title	Teaching Hours / Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics – III	04		03	80	20	100	4
2	15CV32	Strength of Materials	04		03	80	20	100	4
3	15CV33	Fluid Mechanics	04		03	80	20	100	4
4	15CV34	Basic Surveying	04		03	80	20	100	4
5	15CV35	Engineering Geology	04		03	80	20	100	4
6	15CV36	Building Materials and Construction	04		03	80	20	100	4
7	15CVL37	Building Materials Testing Laboratory		1I+2P	03	80	20	100	2
8	15CVL38	Basic Surveying Practice		1I+2P	03	80	20	100	2
TOTAL			24	6	24	640	160	800	28

Note:

<i>Core Subjects:</i>	<i>15CV31, 15CV32, 15CV33, 15CV34, 15CV35, 15CV36</i>
<i>Laboratory & Practice:</i>	<i>15CVL37, 15CVL38</i>

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. CIVIL ENGINEERING

(Common to _____)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours / Week		Examination				Credits
			Theory	Practical / Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15MAT31	Engineering Mathematics – IV	04		03	80	20	100	4
2	15CV42	Analysis of Determinate Structures	04		03	80	20	100	4
3	15CV43	Applied Hydraulics	04		03	80	20	100	4
4	15CV 44	Concrete Technology	04		03	80	20	100	4
5	15CV45	Basic Geotechnical Engineering	04		03	80	20	100	4
6	15CV46	Advanced Surveying	04		03	80	20	100	4
7	15CVL47	Fluid Mechanics Laboratory		1I+2P	03	80	20	100	2
8	15CVL48	Engineering Geology Laboratory		1I+2P	03	80	20	100	2
TOTAL			24	06	24	640	160	800	28

Note:

<i>Core Subjects:</i>	<i>15CV 41, 15CV42, 15CV43, 15CV 44, 15CV45, 15CV46</i>
<i>Laboratory & Practice:</i>	<i>15CVL47, 15CVL48</i>

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. CIVIL ENGINEERING

V SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CV51	Design of RC Structural Elements	04		03	80	20	100	4
2	15CV52	Analysis of Indeterminate Structures	04		03	80	20	100	4
3	15CV53	Applied Geotechnical Engineering	04		03	80	20	100	4
4	15CV54	Computer Aided Building Planning and Drawing	01	3D	03	80	20	100	4
5	15CV55X	Professional Elective-1	03		03	80	20	100	3
6	15CV56X	Open Elective-1	03		03	80	20	100	3
7	15CVL57	Geotechnical Engineering Laboratory		1I+2P	03	80	20	100	2
8	15CVL58	Concrete and Highway Materials Laboratory		1I+2P	03	80	20	100	2
TOTAL			19	09	24	640	160	800	26

Professional Elective 1		Open Elective 1	
15CV552	Railways, Harbours, tunneling and Airports	15CV561	Traffic Engineering

1. **Professional Elective:** Elective relevant to chosen specialization/ branch
2. **Open Elective:** Electives from other technical and/or emerging subject areas

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SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. CIVIL ENGINEERING

VI SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15CV61	Construction Management and Entrepreneurship	04		03	80	20	100	4
2	15CV62	Design of Steel Structural Elements	04		03	80	20	100	4
3	15CV63	Highway Engineering	04		03	80	20	100	4
4	15CV64	Water Supply and Treatment Engineering	04		03	80	20	100	4
5	15CV65X	Professional Elective 2	03		03	80	20	100	3
6	15CV66X	Open Elective 2	03		03	80	20	100	3
7	15CVL67	Software Application Lab		1I+2P	03	80	20	100	2
8	15CVP68	Extensive Survey Project /Camp		1I+2P	03	80	20	100	2
TOTAL			22	6	24	640	160	800	26

Professional Elective-2		Open Elective-2	
15CV651	Solid Waste Management	15CV661	Water Resource Management

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

B.E. CIVIL ENGINEERING

VII SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	15CV71	Municipal and Industrial Waste Water Engineering	04		03	20	80	100	4
2	15CV72	Design of RCC and Steel Structures	04		03	20	80	100	4
3	15CV73	Hydrology and Irrigation Engineering	04		03	20	80	100	4
4	15CV74X	Professional Elective 3	03		03	20	80	100	3
5	15CV75X	Professional Elective 4	03		03	20	80	100	3
6	15CVL76	Environmental Engineering Laboratory		1I+2P	03	20	80	100	2
7	15CVL77	Computer Aided Detailing of Structures		1I+2D	03	20	80	100	2
8	15CVP78	Project Phase I +Project Seminar		3		100		100	2
TOTAL			18	9	21	240	560	800	24

Professional Elective 3		Professional Elective 4	
15CV742	Ground Water & Hydraulics	15CV753	Rehabilitation and Retrofitting of Structures

1. Project Phase-I + Seminar: Literature Survey, Problem Identification, objectives and Methodology, Submission of synopsis and seminar

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. CIVIL ENGINEERING

VIII SEMESTER

Sl. No.	Subject Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Drawing	Duration	I.A. Marks	Theory/ Practical Marks		Total Marks
1	15CV81	Quantity Surveying and Contracts Management	4	-	3	20	80	100	4
2	15CV82	Design of Pre Stressed Concrete Elements	4	-	3	20	80	100	4
3	15CV83X	Professional Elective 5	3	-	3	20	80	100	3
4	15CV84	Internship/Professional Practice	Industry Oriented		3	50	50	100	2
5	15CVP85	Project Work	-	6	3	100	100	200	6
6	15CVS86	Seminar on current trends in Engineering and Technology	-	4	-	100	-	100	1
TOTAL			11	10	15	310	390	700	20

Professional Elective 5	
15CV833	Pavement Design

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: STRENGTH OF MATERIALS B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV32	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students;			
<ol style="list-style-type: none"> 1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements. 2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements. 3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements. 4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials. 5. To evaluate the behavior of torsional members, columns and struts. 			
Module-1			
Simple Stresses and Strain:			
Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.			
L1, L2			
Module-2			
Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses			
Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lamé's equation, radial and hoop stress distribution.			
L2,L4			

Module-3
<p>Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.</p> <p style="text-align: right;">L2,L4</p>
Module-4
<p>Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.</p> <p>Theories of Failure: Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory).</p> <p style="text-align: right;">L2 ,L4</p>
Module-5
<p>Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'T', and 'T' sections. Shear centre(only concept)</p> <p>Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.</p> <p style="text-align: right;">L1,L2,L4</p>
<p>Course outcomes: After studying this course, students will be able;</p> <ol style="list-style-type: none"> 1. To evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion. 2. To suggest suitable material from among the available in the field of construction and manufacturing. 3. To evaluate the behavior and strength of structural elements under the action of compound stresses and thus understand failure concepts 4. To understand the basic concept of analysis and design of members subjected to torsion. 5. To understand the basic concept of analysis and design of structural elements such as columns and struts.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010 2. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko “ Elements of Strength of Materials” East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2. R K Bansal, “A Textbook of Strength of Materials”, 4th Edition, Laxmi Publications, 2010
3. S.S. Rattan “ Strength of Materials” McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

TITLE OF THE COURSE: FLUIDS MECHANICS
B.E., III Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV33	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: The objectives of this course is to make students to learn:

1. The Fundamental properties of fluids and its applications.
2. Hydrostatic laws and application to practical problem solving
3. Principles of Kinematics and Hydro-Dynamics for practical applications
4. Basic design of pipes and pipe networks considering flow, pressure and its losses.
5. The basic flow rate measurements

Module-1

Fluids & Their Properties: Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension & Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems). Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices.

L2,L3

Module-2

Hydrostatic forces on Surfaces: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems.

Fundamentals of fluid flow (Kinematics): Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irrotational motion. Potential function, stream function, orthogonality of streamlines and equipotential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.

L2,L4

Module-3
<p>Fluid Dynamics: Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends.</p> <p>Applications: Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems</p> <p style="text-align: right;">L2,L4</p>
Module-4
<p>Orifice and Mouthpiece: Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification, Borda's Mouthpiece (No problems).</p> <p>Notches and Weirs: Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.</p> <p style="text-align: right;">L1,L2,L4</p>
Module-5
<p>Flow through Pipes: Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems.</p> <p>Surge Analysis in Pipes: Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems</p> <p style="text-align: right;">L2 ,L4</p>
<p>Course outcomes: After successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Possess a sound knowledge of fundamental properties of fluids and fluid Continuum 2. Compute and solve problems on hydrostatics, including practical applications 3. Apply principles of mathematics to represent kinematic concepts related to fluid flow 4. Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications 5. Compute the discharge through pipes and over notches and weirs
<p>Text Books:</p> <ol style="list-style-type: none"> 1. P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi 2. R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi 3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics",

- Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)
2. K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
 3. K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
 4. J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition
 5. 5. Mohd.Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press

TITLE OF THE COURSE: BASIC SURVEYING
B.E., III Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV34	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: This course will enable students to;

1. Understand the basic principles of Surveying
2. Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.
3. Employ conventional surveying data capturing techniques and process the data for computations.
4. Analyze the obtained spatial data to compute areas and volumes and draw contours to represent 3D data on plane figures.

Module-1

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveys. Principles of surveying. Units of measurements, Surveying measurements and errors, types of errors, precision and accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout, Survey of India Map numbering systems.

Measurement of Horizontal Distances: Measuring tape and types. Measurement using tapes, Taping on level ground and sloping ground. Errors and corrections in tape measurements, ranging of lines, direct and indirect methods of ranging, Electronic distance measurement, basic principle. Booking of tape survey work, Field book, entries, Conventional symbols, Obstacles in tape survey, Numerical problems.

L1, L2

Module-2

Measurement of Directions and Angles: Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Theodolite Survey and Instrument Adjustment: Theodolite and types, Fundamental axes and parts of Transit theodolite, uses of theodolite, Temporary adjustments of transit theodolite, measurement of horizontal and vertical angles, step by step procedure for obtaining permanent adjustment of Transit theodolite

L2,L3

Module-3

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems

<p>Tacheometry: basic principle, types of tacheometry, distance equation for horizontal and inclined line of sight in fixed hair method, problems</p> <p style="text-align: right;">L1, L2</p>
<p>Module-4</p>
<p>Leveling: Basic terms and definitions, Methods of leveling, Dumpy level, auto level, digital and laser levels. Curvature and refraction corrections. Booking and reduction of levels. Differential leveling, profile leveling, fly leveling, check leveling, reciprocal leveling, trigonometric leveling (heights and distances-single plane and double plane methods.)</p> <p style="text-align: right;">L3,L4</p>
<p>Module-5</p>
<p>Areas and Volumes: Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson’s one third rule, area from co-ordinates, introduction to planimeter, digital planimeter. Measurement of volumes- trapezoidal and prismatic formula.</p> <p>Contouring: Contours, Methods of contouring, Interpolation of contours, contour gradient, characteristics of contours and uses.</p> <p style="text-align: right;">L2,L3</p>
<p>Course outcomes: After a successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Posses a sound knowledge of fundamental principles Geodetics 2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems. 3. Capture geodetic data to process and perform analysis for survey problems] 4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.C. Punmia, “Surveying Vol.1”, Laxmi Publications pvt. Ltd., New Delhi – 2009. 2. Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. S.K. Duggal, “Surveying Vol.1”, Tata McGraw Hill Publishing Co. Ltd. New Delhi.2009. 2. K.R. Arora, “Surveying Vol. 1” Standard Book House, New Delhi. – 2010 3. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi 4. A. Bannister, S. Raymond , R. Baker, “Surveying”, Pearson, 7th ed., New Delhi

TITLE OF THE COURSE: ENGINEERING GEOLOGY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV35	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students;			
<ol style="list-style-type: none"> 1. To understand the internal structure and composition of the earth. 2. To comprehend the properties, occurrence and uses of minerals in various industries. 3. To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects. 4. To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways. 5. To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management. 			
Module-1			
Introduction: Application of Earth Science in Civil Engineering Practices, Understanding the earth, internal structure and composition.			
Mineralogy: Mineral properties, composition and their use in the manufacture of construction materials – Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement); Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromite (Alloy); Bauxite (aluminum); Chalcopyrite (copper)			
L1,L2			
Module-2			
Petrology: Formation, Classification and Engineering Properties. Rock as construction material, concrete aggregate, railway ballast, roofing, flooring, cladding and foundation. Deformation of rocks, Development of Joints, Folds, Faults and Unconformities. Their impact in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges, Rock Quality Determination (RQD), Rock Structure Rating (RSR),: Igneous Rocks - Granite, Gabbro, Dolerite, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite, Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite			
L2,L3.			
Module-3			
Geomorphology and Seismology: Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Study of Geo-morphological			

aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges. Watershed management, Floods and their control, River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake - Causes and Effects,, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones- World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control

L2, L3, L5.

Module-4

Hydrogeology: Hydrological cycle, Occurrence of Groundwater in different terrains -Weathered, Hard and Stratified rocks; Determination of Quality aspects - SAR, RSC and TH of Groundwater. Groundwater Pollution, Groundwater Exploration- Electrical Resistivity and Seismic methods, Resistivity curves, Water Bearing Formations, Aquifer types and parameters - Porosity, Specific yield and retention, Permeability, Transmissibility and Storage Coefficient. Springs and Artesian Wells, Artificial Recharging of Groundwater, Sea water intrusion and remedies.

L4,L5

Module-5

Geodesy: Study of Topographic maps and Contour maps; Remote Sensing – Concept, Application and its Limitations; Geographic Information System (GIS) and Global Positioning System (GPS) – Concept and their use resource mapping. LANDSAT Imagery–Definition and its use. Impact of Mining, Quarrying and Reservoirs on Environment. Natural Disasters and their mitigation.

L2,L3, L5

Course outcomes: After a successful completion of the course, the student will be able to:

1. Students will able to apply the knowledge of geology and its role in Civil Engineering
2. Students will effectively utilize earth’s materials such as mineral, rocks and water in civil engineering practices.
3. Analyze the natural disasters and their mitigation.
4. Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems.
5. Apply and asses use of building materials in construction and asses their properties

Text Books:

1. P.K. Mukerjee, “A Text Book of Geology”, World Press Pvt., Ltd. Kolkatta.
2. Parbin Singh, “Text Book of Engineering and General Geology”, Published by S.K.Kataria and Sons, New Dehli

Reference Books:

1. Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
2. Dimitri P Krynine and William R Judd, “Principles of Engineering Geology and

- Geotechnics”, CBS Publishers and Distributors, New Delhi.
3. K V G K Gokhale, “Principles of Engineering Geology”, BS Publications, Hyderabad.
 4. M Anji Reddy, “Text book of Remote Sensing and Geographical Information System”, BS Publications, Hyderabad.
 5. Ground water Assessment, development and Management by K.R. Karanth, Tata Mc Graw Hills
 6. K. Todd, “Groundwater Hydrology”, Tata Mac Grow Hill, New Delhi.
 7. D. Venkata Reddy, “Engineering Geology”, New Age International Publications, New Delhi.
 8. S.K Duggal, H.K Pandey and N Rawal, “Engineering Geology”, McGraw Hill Education (India) Pvt, Ltd. New Delhi.
 9. M.P Billings, “Structural Geology”, CBS Publishers and Distributors, New Delhi.
 10. K. S. Valdiya, “ Environmental Geology”, , Tata Mc Grew Hills.
 11. M. B. Ramachandra Rao, “Outlines of Geophysical Prospecting- A Manual for Geologists”, Prasaraanga, University of Mysore, Mysore

TITLE OF THE COURSE: Building Materials and Construction B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV36	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: This course will develop a student;

1. In recognizing the good materials to be used for the construction work
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures
3. In supervision of different types of masonry
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning and to take suitable engineering measures.

Module-1

Building Materials: Stone as building material; Requirement of good building

stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage.

Cement Concrete blocks, Stabilized Mud Blocks, Sizes, requirement of good blocks.

Mortar: types and requirements. Timber as construction material

Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specific gravity, bulking, moisture content, deleterious materials.

Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

L1 L2

Module-2

Foundation: Preliminary investigation of soil, safe bearing capacity of soil,

Function and requirements of good foundation , types of foundation , introduction to spread, combined , strap, mat and pile foundation

Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry, Bonds in brick work, Header, Stretcher, English, Flemish bond, Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls; load bearing, partition walls, cavity walls

L1,L2

Module-3
<p>Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.</p> <p>Floors and roofs: Floors; Requirement of good floor, Components of ground floor, Selection of flooring material, Laying of Concrete, Mosaic, Marble, Granite, Tile flooring, Cladding of tiles. Roof;-Requirement of good roof, Types of roof, Elements of a pitched roof, Trussed roof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.</p> <p style="text-align: right;">L3</p>
Module-4
<p>Doors, Windows and Ventilators: Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Paneled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations</p> <p>Stairs: Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.</p> <p>Formwork: Introduction to form work, scaffolding, shoring, under pinning.</p> <p style="text-align: right;">L2 L3 L5</p>
Module-5
<p>Plastering and Pointing : purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering Damp proofing- causes, effects and methods.</p> <p>Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.</p> <p style="text-align: right;">L4 L5</p>
<p>Course outcomes: After a successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Select suitable materials for buildings and adopt suitable construction techniques. 2. Adopt suitable repair and maintenance work to enhance durability of buildings.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sushil Kumar “Building Materials and construction”, 20th edition, reprint 2015, Standard Publishers 2. Dr. B.C.Punmia, Ashok kumar Jain, Arun Kumar Jain, “Building Construction, Laxmi Publications (P) ltd., New Delhi. 3. Rangawala S. C. “Engineering Materials”, Charter Publishing House, Anand, India.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. S.K.Duggal, “Building Materials”, (Fourth Edition) New Age International (P) Limited, 2016 National Building Code(NBC) of India 2. P C Vergese, “Building Materials”, PHI Learning Pvt. Ltd 3. Building Materials and Components, CBRI, 1990, India 4. Jagadish.K.S, “Alternative Building Materials Technology”, New Age International, 2007. 5. M. S. Shetty, “Concrete Technology”, S. Chand & Co. New Delhi.

TITLE OF THE COURSE: BUILDING MATERIALS TESTING LABORATORY B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17CVL37	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives: The objectives of this course is to make students to learn:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Experiments:

1. Tension test on mild steel and HYSD bars.
2. Compression test on mild steel, cast iron and wood.
3. Torsion test on mild steel circular sections
4. Bending Test on Wood Under two point loading
5. Shear Test on Mild steel- single and double shear
6. Impact test on Mild Steel (Charpy & Izod)
7. Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's
8. Tests on Bricks and Tiles
9. Tests on Fine aggregates-Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
10. Tests on Coarse aggregates-Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
11. Demonstration of Strain gauges and Strain indicators

NOTE: All tests to be carried out as per relevant latest BIS Codes

Course outcomes: After successful completion of the course, the students will be able to:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
3. Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.

Question paper pattern:

- Group experiments - Tension test, compression test, torsion test and

bending test.

- Individual Experiments - Remaining tests.
- Two questions are to be set - One from group experiments and the other as individual experiment.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education(India)Pvt. Ltd., 2014
3. Fenner, " Mechanical Testing of Materials", George Newnes Ltd. London.
4. Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
5. Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd.New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors 1996.
- 7. Relevant latest IS Codes**

TITLE OF THE COURSE: BASIC SURVEYING PRACTICE B.E., III Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CVL38	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Hours	40	Exam Hours	03
RBT Levels	L1, L2, L3, L4		
Credits – 02			
Course Objectives: The objectives of this course is to make students to:			
<ol style="list-style-type: none"> 1. Apply the basic principles of engineering surveying and measurements 2. Follow effectively field procedures required for a professional surveyor 3. Use techniques, skills and conventional surveying instruments necessary for engineering practice. 			
Experiments:			
1. a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging.			
b) Setting out perpendiculars. Use of cross staff, optical square			
2. Obstacles in chaining and ranging – Chaining but not ranging, ranging but not chaining, both ranging and chaining.			
3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.			
4. Measurement of bearings of sides of a closed traverse and adjustment of closing error by Bowditch method.			
5. Determination of distance between two inaccessible points using compass and accessories			
6. Determination of reduced levels of points using dumpy level/auto level (simple leveling)			
7. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)			
8. To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error			
9. To conduct profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block contour on graph paper to scale			
10. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite.			
11. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double plane method.			
12. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.			
13. Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule.			
14. Demonstration of Minor instruments Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical sextant and Pentagraph			

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the basic principles of engineering surveying for linear and angular measurements.
2. Comprehend effectively field procedures required for a professional surveyor.
3. Use techniques, skills and conventional surveying instruments necessary for engineering practice.

Question paper pattern:

- All are individual experiments.
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. B.C. Punmia, **“Surveying Vol.1”**, Laxmi Publications pvt. Ltd., New Delhi 2009.
2. Kanetkar T P and S V Kulkarni , **Surveying and Levelling Part I**, Pune VidyarthiGrihaPrakashan, 1988
3. S.K. Duggal, **“Surveying Vol.1”**, Tata McGraw Hill Publishing Co. Ltd. New Delhi.-2009.
4. K.R. Arora, **“Surveying Vol. 1”** Standard Book House, New Delhi. – 2010 & Distributors 1996.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: Analysis of Determinate Structures B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students to			
<ol style="list-style-type: none"> 1. Apply knowledge of mathematics and engineering in calculating slope and deflections 2. Identify, formulate and solve engineering problems 3. Analyse structural systems and interpret data 4. Engage in lifelong learning with the advances in Structural Engineering 			
Module-1			
Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.			
L2,L4,L5			
Module-2			
Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple. Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.			
L2,L4,L5			
Module-3			
Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit			

load method.	L2,L4,L5
Module-4	
Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.	L2, L4, L5
Module-5	
Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts.	L2, L4, L6
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Evaluate the forces in determinate trusses by method of joints and sections. 2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods 3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames. 4. Determine the stress resultants in arches and cables. 5. Understand the concept of influence lines and construct the ILD diagram for the moving loads. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi. 2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015. 3. Bhavikatti, Structural Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014 2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008. 3. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007. 	

TITLE OF THE COURSE: Applied Hydraulics B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV43	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional

homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham π theorem, dimensional analysis, choice of variables, examples on various applications.

Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification, Reynolds model, Froude's model, Euler's Model, Webber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

Module-2

Open Channel Flow Hydraulics:

Uniform Flow: Introduction, Classification of flow through channels, Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3,L4

Module-3

Non-Uniform Flow: Hydraulic Jump, Expressions for conjugate depths and Energy

loss, Numerical Problems Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems, Control sections

L2,L3,L4

Module-4

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of ajet on a stationary and moving curved vanes, Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems

Turbines – Impulse Turbines: Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems

L1, L2, L3,L4

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine- Descriptions, working proportions and design, Numerical problems. (ii) Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

L1,L2, L3,L4

Course outcomes:

After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Text Books:

1. P N Modi and S M Seth, “Hydraulics and Fluid Mechanics, including Hydraulic Machines”, 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, “A Text book of Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi
3. S K SOM and G Biswas, “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw Hill, New Delhi
1. K Subramanya, “Fluid Mechanics and Hydraulic Machines”, Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, “Fluid Mechanics and Machinery”, Oxford University Press
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, “*Fluid Mechanics and Machinery*”, Oxford University Publication – 2010
4. J.B. Evett, and C. Liu, “*Fluid Mechanics and Hydraulics*”, McGraw-Hill Book Company.-2009.

TITLE OF THE COURSE: Concrete Technology B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course objectives: This course will enable students to:			
<ol style="list-style-type: none"> 1. Recognize the importance of material characteristics and their contributions to strength development in Concrete 2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete. 3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures. 			
Module-1			
Concrete Ingredients			
<p>Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolan and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.</p>			
L1, L2, L3			
Module-2			
Fresh Concrete			
<p>Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.</p>			
L1, L2, L3			
Module-3			
Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity			
<p>concept, Testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per</p> <p>IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.</p>			

L1, L2, L3
Module-4
<p>Concrete Mix Proportioning</p> <p>Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262</p> <p style="text-align: right;">L1, L2, L3, L4</p>
Module-5
<p>Special Concretes</p> <p>RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications</p> <p style="text-align: right;">L1, L2, L3 L4</p>
<p>Course outcomes:</p> <p>After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Relate material characteristics and their influence on microstructure of concrete. 2. Distinguish concrete behaviour based on its fresh and hardened properties. 3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Neville A.M. "Properties of Concrete"-4th Ed., Long man. 2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi. 3. Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014 4. A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition) <ol style="list-style-type: none"> 1. M L Gambir, "Concrete Technology", McGraw Hill Education, 2014. 2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9 3. Job Thomas, "Concrete Technology", CENGAGE Learning , 2015 4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC 5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

TITLE OF THE COURSE: Basic Geotechnical Engineering B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV45	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students			
<ol style="list-style-type: none"> 1. To appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering. 2. To know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils. 3. To determine the improvement in mechanical behaviour by densification of soil deposits using compaction. 4. To know how the properties of soils that can be measured in the lab 			
Module-1			
Introduction:			
Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg's Limits, consistency indices, relative density, activity of clay, Plasticity chart, unified and BIS soil classification.			
L1, L2			
Module-2			
Soil Structure and Clay Mineralogy			
Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and ontmorillonite and their application in Engineering			
Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control - compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.			
L1, L2			
Module-3			
Flow through Soils:			
Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena			
Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications. Flow nets for sheet piles and below the dam section.			

<p>Unconfined flow, phreatic line (Casagrande's method –with and without toe filter), flow through dams, design of dam filters.</p> <p>Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena</p> <p style="text-align: right;">L1, L2, L3</p>
Module-4
<p>Consolidation of Soil:</p> <p>Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations. Derivation of Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (C_c, a_v, m_v and C_v. Laboratory one dimensional consolidation test, characteristics of e-$\log(\sigma)$ curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.</p> <p style="text-align: right;">L1, L2, L3,</p>
L4Module-5
<p>Shear Strength of Soil:</p> <p>Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion</p> <p>Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Total and effective stress paths.</p> <p style="text-align: right;">L2, L3</p>
<p>Course outcomes:</p> <p>On the completion of this course students are expected to attain the following outcomes;</p> <ol style="list-style-type: none"> 1. Will acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties 2. Will be able to determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures 3. Will be able to determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structure 4. Will be able to estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory. 5. Ability to solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., Newe Delhi. 2. Punmia B C, Soil Mechanics and Foundation Engineering- (2012) , Laxmi Pulications. 3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4th Edition, UBS Publishers and Distributors, New Delhi. 4. Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson

Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley & Sons, 1969.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. (2009), "Tata Mc Graw Hill.
4. Narasimha Rao A. V. & Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2010), 3rd Edition, John Wiley & Sons

TITLE OF THE COURSE: Advanced Surveying B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV46	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students to:			
<ol style="list-style-type: none"> 1. Apply geometric principles to arrive at solutions to surveying problems. 2. Analyze spatial data using appropriate computational and analytical techniques. 3. Design proper types of curves for deviating type of alignments. 4. Use the concepts of advanced data capturing methods necessary for engineering practice 			
Module-1			
Curve Surveying			
<p>Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics , numerical problems on Length of Transition curve, Vertical curves –Types – (theory).</p>			
L1,L3,L5			
Module-2			
Geodetic Surveying and Theory of Errors			
<p>Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.</p>			
L1,L2, L3			
Module-3			
Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial coordinate systems, spherical triangle, astronomical triangle, Napier’s rule			
L4,L5			

Module-4
<p>Aerial Photogrammetry Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax</p> <p style="text-align: right;">L2,L3, L5</p>
Module-5
<p>Modern Surveying Instruments Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).</p> <p style="text-align: right;">L2,L3, L5</p>
<p>Course outcomes: After a successful completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Apply the knowledge of geometric principles to arrive at surveying problems 2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems. 3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments; 4. Design and implement the different types of curves for deviating type of alignments.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi. 2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan, 3. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. 4. Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi <p>Reference Books:</p> <ol style="list-style-type: none"> 1. S.K. Duggal, "Surveying Vol.I & II", Tata McGraw Hi ll Publishing Co. Ltd. New Delhi. 2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi. 3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers 4. B Bhatia, Remote Sensing and GIS , Oxford University Press, New Delhi. 5. T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India 6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication. 7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill Higher Education

TITLE OF THE COURSE: Fluid Mechanics and Hydraulic Machines Laboratory B.E., IV Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CVL47	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Hours	40	Exam Hours	03
RBT Levels	L1, L2, L3, L4		
Credits – 02			
Course Objectives: This course will enable students to;			
1. calibrate flow measuring devices			
2. determine the force exerted by jet of water on vanes			
3. measure discharge and head losses in pipes			
4. understand the fluid flow pattern			
Experiments:			
1. Verification of Bernoulli's equation			
2. Determination of Cd for Venturimeter and Orifice meter			
3. Determination of hydraulic coefficients of small vertical orifice			
4. Calibration of Rectangular and Triangular notch			
5. Calibration of Ogee and Broad crested weir			
6. Determination of Cd for Venturiflume			
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).			
8. Experimental determination of operating characteristics of Pelton turbine			
9. Determination of efficiency of Francis turbine			
10. Determination of efficiency of Kaplan turbine			
11. Determination of efficiency of centrifugal pump			
12. Determination of Major and Minor Losses in Pipes			
13. Demonstration Experiments:			
a. Reynold's experiment to understand laminar and turbulent flow			
b. Flow Visualization			
c. Calibration of Sutro-weir			
Course outcomes: During the course of study students will develop understanding of:			
1. Properties of fluids and the use of various instruments for fluid flow measurement.			
2. Working of hydraulic machines under various conditions of working and their characteristics.			
<ul style="list-style-type: none"> • All experiments are to be included in the examination except demonstration exercises. • Candidate to perform experiment assigned to him • Marks are to be allotted as per the split up of marks shown on the cover page of answer script 			
Reference Books:			
1. Sarbjit Singh , <i>Experiments in Fluid Mechanics</i> - PHI Pvt. Ltd.- New Delhi			
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press			
3. Hydraulics and Fluid Mechanics' – Dr. P.N. Modi & D r S.M. Seth, Standard Book House- New Delhi. 2009 Edition			

Title of the Course: Engineering Geology Laboratory

BE–IV SEMESTER Civil Engineering [As per Choice Based Credit System (CBCS) scheme]

Subject Code		17CVL48	CIE Marks	40
Number of Hours/Week	Lecture	03(1hr tutorial+2hr laboratory)	SEE Marks	50
Total Number of Hours	Lecture	40 hr	Exam Hours	03
RBT Levels	L1, L2, L3, L4			
CREDITS–02				
Course objectives: This course will enable students				
<ol style="list-style-type: none"> 1. To identify the minerals and rocks based on their inherent properties and uses in civil engineering 2. To interpret the geological maps related to civil engineering projects. 3. To learn the dip and strike, borehole problems, thickness of geological formation related to foundation, tunnels, reservoirs and mining. 4. To understand subsurface geological conditions through geophysical techniques and watershed management. 5. To visit the civil engineering projects like dams, reservoirs, tunnels, quarry sites etc. 				
Modules			Teaching Hours	Revised Bloom's Taxonomy (RBT Level)
1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.			6 Hours	L1, L2, L3
2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and decorative purposes			6 Hours	L1, L2, L3
3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) – graphical or any other method.			6 Hours	L3, L4
4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining. Triangular and Square			6 Hours	L3, L4
5. Calculation of Vertical, True thickness and width of the outcrops.			3 Hours	L3, L4
6. Interpretation of Electrical resistivity curve to find out subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone			4 Hours	L3, L4
7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects			9 Hours	L2, L3, L4

Course outcomes:

During this course, students will develop expertise in;

1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices
2. Understanding and interpreting the geological conditions of the area for the implementation of civil engineering projects.
3. Interpreting subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.
4. The techniques of drawing the curves of electrical resistivity data and its interpretation for geotechnical and aquifer boundaries

Program Objectives (as per NBA):

- o Engineering Knowledge.
- o Problem Analysis.
- o Design/development of solutions (partly).
- o Interpretation of data.

Question paper pattern: Question paper should be set for 100 marks

All are individual experiments

Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.

All exercises are to be included for practical examination.

Question Paper Pattern		
Qn.No.	EXPERIMENT	MARKS(100)
1	Identification of Minerals by giving their physical properties and civil engineering applications (5 minerals)	25(5 x5)
2	Identification of rocks by giving their physical properties, classification and their civil engineering applications (5 rocks)	25(5 x5)
3	Dip and strike problems	7
4	Borehole problems (3 point method)	12
5	Thickness of strata problems including calculation of vertical, true thickness and its width of out crop.	5
6	Electrical resistivity curves drawing and its interpretation for Geotechnical and Aquifer investigations.	7
7	Interpretation of Toposheets	6
8	Geological maps, their cross sections and description	15
9	Vivavoce	5

Note:

- 1) Question nos. 1, 2, 4, 5, 7, 8 & 9 are compulsory.
- 2) **Among question no. 3 & 6 anyone shall be given.**
- 3) Internal Assessment Marks = **40**: By conducting at least one test for **20 marks** remaining
a) **10 marks for record** and b) **10 marks for field visit report submission** (Engineering projects)

ReferenceBooks:

1. MPBillings,StructuralGeology,CBSPublishersandDistributors,NewDelhi
2. B.S.SatyanarayanaSwamy, Engineering Geology Laboratory Manual , DhanpatRai Sons,NewDelhi.
3. LRANarayan,Remotesensinganditsapplications,UniversityPress.
4. P.K.MUKERJEE,TextbookofGeology,WorldPressPvt.Ltd.,Kolkatta
5. JohnIPlattandJohnChallinor,SimpleGeologicalStructures,ThomasMurthy&Co,London

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

5th Semester

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

TITLE OF THE COURSE: DESIGN OF RC STRUCTURAL ELEMENTS B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CV51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
<p>Course objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading. 2. Follow a procedural knowledge in designing various structural RC elements. 3. Impart the culture of following the codes for strength, serviceability and durability as an ethics. 4. Provide knowledge in analysis and design of RC elements for the success in competitive examinations. 			
Module-1			
<p>Introduction to Limit State Design and Serviceability: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety.</p> <p>Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.</p> <p>Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.</p> <p style="text-align: right;">L1, L2</p>			
Module-2			
<p>Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear</p> <p style="text-align: right;">L2, L4</p>			
Module-3			
<p>Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456</p> <p style="text-align: right;">L2, L4</p>			
Module-4			
<p>Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.</p> <p style="text-align: right;">L2, L4</p>			
Module-5			
<p>Limit State Design of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design</p>			

concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment

L2, L4

Course outcomes: After studying this course, students will be able to:

1. understand the design philosophy and principles
2. solve engineering problems of RC elements subjected to flexure, shear and torsion
3. demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings
4. owns professional and ethical responsibility

- The designs are as per IS-456 and SP (16) relevant charts to be provided in the question paper

Text Books:

1. Unnikrishnan Pillai and Devdas Menon, “ **Reinforced Concrete Design**” , McGraw Hill, New Delhi
2. Subramanian, “ **Design of Concrete Structures**” , Oxford university Press
3. H J Shah, “**Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)**” , Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, “Limit State design of reinforced concrete” , PHI, New Delhi
2. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publisher s
3. Kong and Evans, “Reinforced and Pre-Stressed Concrete”, Springer Publications
4. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press
5. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.

TITLE OF THE COURSE: ANALYSIS OF INDETERMINATE STRUCTURES B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CV52	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Objectives: This course will enable students to 1. Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method. 2. Identify, formulate and solve problems in structural analysis. 3. Analyze structural system and interpret data. 4. use the techniques, such as stiffness and flexibility methods to solve engineering problems 5. communicate effectively in design of structural elements			
Module-1			
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3 <div style="text-align: right;">L2, L4, L5</div>			
Module-2			
Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of 08 Hours orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3 <div style="text-align: right;">L2, L4, L5</div>			
Module-3			
Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway <div style="text-align: right;">L2, L4, L5</div>			
Module-4			
Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤ 3 <div style="text-align: right;">L2, L4, L5</div>			
Module-5			
Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤ 3 <div style="text-align: right;">L2, L4, L5</div>			
Course outcomes: After studying this course, students will be able to: 1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope deflection method 2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method. 3. Construct the bending moment diagram for beams and frames by Kani's method. 4. Construct the bending moment diagram for beams and frames using flexibility			

method

5. Analyze the beams and indeterminate frames by system stiffness method.

Text Books:

1. Hibbeler R C, “ **Structural Analysis**”, Pearson Publication
2. L S Negi and R S Jangid, “**Structural Analysis**”, Tata *McGraw-Hill* Publishing Company Ltd.
3. D S Prakash Rao, “**Structural Analysis: A Unified Approach**” , Universities Press
4. K.U. Muthu, H.Narendra etal, “**Indeterminate Structural Analysis**”, IK International Publishing Pvt. Ltd.

Reference Books:

1. Reddy C S, “**Basic Structural Analysis**”, *Tata McGraw-Hill* Publishing Company Ltd.
2. Gupta S P, G S Pundit and R Gupta, “**Theory of Structures**”, Vol II, Tata McGraw Hill Publications company Ltd.
3. V N Vazirani and M M Ratwani, “**Analysis Of Structures** ”, Vol. 2, Khanna Publishers
4. Wang C K, “**Intermediate Structural Analysis**”, McGraw Hill, International Students Edition.
5. S.Rajasekaran and G. Sankarasubramanian, “**Computational Structural Mechanics**”, PHI Learning Pvt. Ltd.,

TITLE OF THE COURSE: APPLIED GEOTECHNICAL ENGINEERING B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17CV53	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course objectives: This course will enable students to			
<ol style="list-style-type: none"> 1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of Civil Engineering. Also to become familiar with foundation engineering terminology and understand how the principles of Geotechnology are applied in the design of foundations 2. Learn introductory concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations 3. Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation 4. Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria 5. Study about assessing stability of slopes and earth pressure on rigid retaining structures 			
Module-1			
Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method). L1,L2,L3			
Module-2			
Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart Foundation Settlement - Approximate method for stress distribution on a horizontal plane, Types of settlements and importance, Computation of immediate and consolidation settlement L2,L3,L4			
Module-3			
Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction. Stability of Slopes : Assumptions, infinite and finite slopes, factor of safety, use of Taylor's stability charts, Swedish slip circle method for C and C- ϕ (Method of slices) soils, Fellenius method for critical slip circle L2,L4,L5			
Module-4			
Bearing Capacity of Shallow Foundation: Types of foundations, 10 Hours determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Effect of water table and eccentricity, field methods - plate load test and SPT Proportioning of shallow foundations- isolated and combined footings (only two columns) L2,L4,L5,L6			
Module-5			
Pile Foundations: Types and classification of piles, single loaded pile capacity in			

cohesionless and cohesive soils by static formula, efficiency of pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation)

L1, L2, L3 L4

Course outcomes: On the completion of this course students are expected to attain the following outcomes;

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5. Capable of estimating load carrying capacity of single and group of piles

Text Books:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India

Reference Books:

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
4. Debashis Moitra, “Geotechnical Engineering”, Universities Press.,
5. Malcolm D Bolton, “A Guide to soil mechanics”, Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications

**TITLE OF THE COURSE: COMPUTER AIDED BUILDING PLANNING AND
DRAWING**

**B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]**

Course Code	17CV54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives: Provide students with a basic understanding

1. Achieve skill sets to prepare computer aided engineering drawings
2. Understand the details of construction of different building elements.
3. Visualize the completed form of the building and the intricacies of construction based on the engineering drawings.

Module-1

Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962
Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customising toolbars, Working with multiple drawings

12 Hours **L1, L2**

Module-2

Drawings Related to Different Building Elements:

Following drawings are to be prepared for the data given using CAD Software

- a. Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings.
- b. Different types of bonds in brick masonry
- c. Different types of staircases – Dog legged, Open well
- d. Lintel and chajja
- e. RCC slabs and beams
- f. Cross section of a pavement
- g. Septic Tank and sedimentation Tank
- h. Layout plan of Rainwater recharging and harvesting system
- i. Cross sectional details of a road for a Residential area with provision for all services
- j. Steel truss (connections Bolted)

Note: Students should sketch to dimension the above in a sketch book before doing the computer drawing

12 Hours **L2, L3, L4, L5, L6**

Module-3

Building Drawings: Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.

Drawing of Plan, elevation and sectional elevation including electrical, plumbing and sanitary services *using CAD software* for:

1. Single and Double story residential building
2. Hostel building
3. Hospital building
4. School building
5. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws

Note:

- *Students should sketch to dimension the above in a sketch book before doing the computer drawing*
- *One compulsory field visit/exercise to be carried out.*
- *Single line diagrams to be given in the examination*

26 Hours **L2,L3, L4, L5, L6**

Course outcomes: After studying this course, students will be able to

1. Gain a broad understanding of planning and designing of buildings
2. Prepare, read and interpret the drawings in a professional set up.
3. Know the procedures of submission of drawings and Develop working and submission drawings for building
4. Plan and design a residential or public building as per the given requirements

Question paper pattern:

- There will be two full questions with sub divisions if necessary from Module 2 with each full question carrying **thirty** marks. Students have to answer one question.
- There will be two full questions from Module 3 with each full question carrying **fifty** marks. Students have to answer one question.
- The conduction of examination and question paper format of should be in lines of 1st year CAED drawing. It's a drawing paper but the exam will be conducted by batches in the computer labs. question papers should be given in batches

Text Books:

1. MG Shah, CM Kale, SY Patki, "**Building drawing with an integrated approach to Built Environment Drawing**", Tata Mc Graw Hill Publishing co. Ltd., New Delhi
2. Gurucharan Singh, "**Building Construction**", Standard Publishers, & distributors, New Delhi.
3. Malik R S and Meo G S, "**Civil Engineering Drawing**", Asian Publishers/Computech Publications Pvt Ltd.

Reference Books:

1. Time Saver Standard by Dodge F. W., F. W. Dodge Corp.,
2. IS: 962-1989 (Code of practice for architectural and building drawing)
3. **National Building Code**, BIS, New Delhi.

TITLE OF THE COURSE: RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS B.E., V Semester, Civil Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17 CV552	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
Credits – 03			
<p>Course Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Understand the history and development, role of railways, railway planning and development based on essential criteria's. 2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction 3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks. 4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids 5. Apply design features of tunnels, harbours, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories. 			
Module-1			
<p>Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.</p> <p style="text-align: right;">L1,L2</p>			
Module-2			
<p>Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construction & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module-3			
<p>Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities , Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.</p> <p>Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.</p> <p style="text-align: right;">L2,L3,L4</p>			
Module-4			
<p>Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.</p>			

Module-5

Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

L3,L4,L5,L6

Course outcomes: After studying this course, students will be able to:

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbor, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Text Books:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee,
4. C Venkatramaiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi

Reference Books:

1. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co.,
2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill
3. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013

TITLE OF THE COURSE: TAFFIC ENGINEERING
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17 CV561	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives: This course will enable students to

1. Understand fundamental knowledge of traffic engineering, scope and its importance.
2. Describe basic techniques for collecting and analysing traffic data, diagnosing problems, designing appropriate remedial treatment, and assessing its effectiveness.
3. Apply probabilistic and queuing theory techniques for the analysis of traffic flow situations and emphasis the interaction of flow efficiency and traffic safety.
4. Understand and analyse traffic issues including safety, planning, design, operation and control.
5. Apply intelligent transport system and its applications in the present traffic scenario.

Module-1

Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

L1,L2,L3

Module-2

Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

L1,L2,L3,L4,L5

Module-3

Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks

L1,L2,L3,L4

Module-4

Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

L1,L2,L3

Module-5

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

L1,L2,L3,L4

Course outcomes: After studying this course, students will be able to:

1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Text Books:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi, 2013
2. S K Khanna and CEG Justo and A Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

Reference Books:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesley Publishing Company, 1996
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005

TITLE OF THE COURSE: GEOTECHNICAL ENGINEERING LAB

B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17CVL57	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Hours	40	Exam Hours	03

RBT LEVEL L1,L2**Credits – 02****Course Objectives:** This course will enable students to;

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

Modules

1. Visual soil classification. Water content determination by oven drying method and infrared moisture method. Specific gravity test (pycnometer and density bottle method).

2. Grain size analysis
- i. Sieve analysis
 - ii. Hydrometer analysis

3. In-situ density tests
- i. Core-cutter method
 - ii. Sand replacement method

4. Consistency limits
- i. Liquid limit test (by Casagrande's and cone penetration method)
 - ii. Plastic limit test
 - iii. Shrinkage limit test

5. Standard compaction test (light and heavy compaction)

6. Co-efficient of permeability test
- i. Constant head test
 - ii. Variable head test

7. Shear strength tests
- i. Unconfined compression test
 - ii. Direct shear test
 - iii. Triaxial test (undrained unconsolidated)

8. Consolidation test : Determination of compression index and co- efficient of consolidation

9. Laboratory vane shear test

10. Demonstration of Swell pressure test, Standard penetration test and boring equipment

Course outcomes: Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics (SPT- Demonstration)

Question paper pattern:

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Punmia B C, Soil Mechanics and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. Bowles J.E., "Engineering Properties of Soil and Their Measurements",- McGraw Hill Book Co. New York.
5. Relevant BIS Codes of Practice: 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1966, IS 2720 (Part-60) 1965.

TITLE OF THE COURSE: CONCRETE AND HIGHWAY MATERIALS LABORATORY
B.E., V Semester, Civil Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17CVL58	CIE Marks	40
Number of Lecture Hours/Week	03=(1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Number of Hours	40	Exam Hours	03
RBT Levels	L1, L2, L3,		
Credits – 02			
Course objectives: This course will enable students			
1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.			
Modules			
Part A: Concrete Lab			
1. Tests on Cement:			
<ul style="list-style-type: none"> a. Normal Consistency b. setting time c. compressive strength d. fineness by air permeability test e. specific gravity 			
2. Tests on Concrete:			
<ul style="list-style-type: none"> a. Design of concrete mix as per IS-10262 b. Tests on fresh concrete: <ul style="list-style-type: none"> i. slump, ii. compaction factor and iii. Vee Bee test c. Tests on hardened concrete: <ul style="list-style-type: none"> i. compressive strength test, ii. split tensile strength test, iii. flexural strength test d. NDT tests by rebound hammer and pulse velocity test. 			
3. Tests on Self Compacting Concrete:			
<ul style="list-style-type: none"> a. Design of self compacting concrete, b. slump flow test, c. V-funnel test, d. J-Ring test, e. U Box test and f. L Box test 			
Part B: High way materials Lab			
1. Tests on Aggregates			
<ul style="list-style-type: none"> a. Aggregate Crushing value b. Los Angeles abrasion test c. Aggregate impact test d. Aggregate shape tests (combined index and angularity number) 			
2. Tests on Bituminous Materials			
<ul style="list-style-type: none"> a. Penetration test b. Ductility test c. Softening point test d. Specific gravity test e. Viscosity test by tar viscometer f. Bituminous Mix Design by Marshall Method (Demonstration only) 			

3. Tests on Soil
 - a. Wet sieve analysis
 - b. CBR test

Course outcomes: During this course, students will develop expertise in;

1. 1. Conduct appropriate laboratory experiments and interpret the results
2. Determine the quality and suitability of cement
3. Design appropriate concrete mix
4. Determine strength and quality of concrete
5. Test the road aggregates and bitumen for their suitability as road material.
6. Test the soil for its suitability as sub grade soil for pavements.

Question paper pattern:

- All are individual experiments
- Instructions as printed on the cover page of answer script for split up of marks to be strictly followed.
- All exercises are to be included for practical examination.

Reference Books:

1. 1. M.L.Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand & Co. Ltd, New Delhi.
3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
4. Neville AM, "Properties of Concrete", ELBS Publications, London.
5. Relevant BIS codes.
6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem Chand Bros, Roorkee
7. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

6th Semester

Course Title: CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV61	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks - 100	
<p>Course Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project. 2. Inculcate Human values to grow as responsible human beings with proper personality. 3. Keep up ethical conduct and discharge professional duties. 			
Module -1			
<p>Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans Construction Project Formulation: Introduction to construction management, project organization, management functions, management styles Construction Planning and Scheduling: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -2			
<p>Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. Construction Equipments: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance Materials: material management functions, inventory management.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -3			
<p>Construction Quality , safety and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. Ethics : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -4			
<p>Introduction to engineering economy : Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making. Interest and time value of money: concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.</p>			

Comparison of alternatives : Present worth, annual equivalent , capitalized and rate of return methods , Minimum Cost analysis and break even analysis

L1,L2,L3

Module -5

Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Understand the construction management process.
2. Understand and solve variety of issues that are encountered by every professional in discharging professional duties.
3. Fulfill the professional obligations effectively with global outlook

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works :

Reference Books:

1. Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
2. Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi
3. Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell
4. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw-Hill Education
5. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh
6. James L.Riggs , David D. Bedworth , Sabah U. Randhawa " Engineering Economics" 4 ed tata Mc Graw hill.
7. S.C Sharma –"Construction Equipments and its management" – Khanna publishers

Course Title: DESIGN OF STEEL STRUCTURAL ELEMENTS As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV62	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	
<p>Course Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel. 2. Learn Bolted connections and Welded connections. 3. Design of compression members, built-up columns and columns splices. 4. Design of tension members, simple slab base and gusseted base. 5. Design of laterally supported and un-supported steel beams. 			
Module -1			
<p>Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.</p> <p>Plastic Behaviour of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -2			
<p>Bolted Connections: Introduction, Types of Bolts, Behaviour of bolted joints, Design of High Strength friction Grip(HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints)</p> <p>Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages of Bolted and Welded Connections.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -3			
<p>Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -4			
<p>Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.</p> <p>Design of Column Bases: Design of Simple Slab Base and Gusseted Base.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -5			
<p>Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behaviour of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.</p> <p>Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]</p> <p style="text-align: right;">L1,L2,L3</p>			
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel 2. Understand the Concept of Bolted and Welded connections. 			

3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.
5. Understand the Concept of Design of laterally supported and un-supported steel beams.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
- There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
- Each full question shall cover the topics as a module
- The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. N Subramanian., “Design of Steel Structures” (2016), Oxford University Press, New Delhi.
2. Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi

Reference Books:

1. Dayarathnam P, “Design of Steel Structures”, S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

Course Title: HIGHWAY ENGINEERING As per Choice Based Credit System (CBCS) scheme SEMESTER:VI			
Subject Code	17CV63	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	
<p>Course objectives: This course will enable students to;</p> <ol style="list-style-type: none"> 1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA. 2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact). 3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network. 4. Understand pavement and its components, pavement construction activities and its requirements. 5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts. 			
Module -1			
<p>Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute</p> <p>Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4th twenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDC) Road development plan - vision 2021.</p>			
L1,L2			
Module -2			
<p>Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects</p> <p>Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves</p>			
L2,L3,L4			
Module -3			
<p>Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials-Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material</p> <p>Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples</p>			
L3,L4,L5			
Module -4			
<p>Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction.</p> <p>Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads</p>			

L2,L3,L4

Module -5

Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods-Examples, Highway financing-BOT-BOOT concepts

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K.P.subramaniam, "Transportation Engineering", SciTech Publications, Chennai.

Reference Books:

1. Relevant IRC Codes
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

Course Title: WATER SUPPLY AND TREATMENT ENGINEERING
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	17CV64	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS –04		Total Marks- 100	

Course objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.
 Different methods of population forecasting -with merits and demerits. Numerical Problems.

L1,L2,L3

Module -2

Water Treatment: Objectives, Treatment flow chart – significance of each unit
 Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.
 Water quality characteristics: Physical, Chemical and Microbiological.

L1,L2,L3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system. Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.

L1,L2,L3

Module -4

Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.
 Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.

L1,L2,L3

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.
 Pumps: Types of pumps with working principles. Numerical Problems.
 Pipes: Design of the economical diameter for the rising main; Numerical Problems.
 Pipe appurtenances, Valves, Fire hydrants
 Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.
 Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.

Visit to Intake structure, Water treatment plant and report working of each unit
Design of water treatment plant units and distribution system with population forecasting for the given city

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and distribute water to the required quality standards.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
2. Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008.

Reference Books:

1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Course Title: GROUND IMPROVEMENT TECHNIQUES As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CV654	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –03		Total Marks- 100	
<p>Course objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Understand the fundamental concepts of ground improvement techniques 2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures. 3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods. 4. Impart the knowledge of geosynthetics, vibration, grouting and Injection. 			
Module -1			
<p>Formation and Development of Ground : Introduction, Formation of Rock, soil and soil profile, Soil distribution in India, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favourable ground conditions, Alternative Approaches, Geotechnical processes.</p> <p>Compaction: Introduction, compaction mechanics, Field procedure, surface compaction, Dynamic Compaction, selection of field compaction procedures, compaction quality control.</p> <p style="text-align: right;">L1, L2 , L3</p>			
Module -2			
<p>Drainage Methods: Introduction, Seepage, filter requirements, ground water and seepage control, methods of dewatering systems, Design of dewatering system including pipe line effects of dewatering. Drains, different types of drains.</p> <p>Pre-compression and Vertical Drains: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading</p> <p style="text-align: right;">L1, L2 , L3</p>			
Module -3			
<p>Chemical Modification-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.</p> <p>Chemical Modification-II: Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.</p> <p style="text-align: right;">L2, L3 , L4</p>			
Module -4			
<p>Vibration Methods: Introduction, Vibro compaction – blasting, vibratory probe, Vibro displacement compaction – displacement piles, vibroflotation, sand compaction piles, stone columns, heavy tamping</p> <p>GROUTING AND INJECTION: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting</p> <p style="text-align: right;">L2 , L3, L5</p>			
Module -5			
<p>Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics - Separation, Filtration and Fluid Transmission, Reinforcement,</p> <p>Miscellaneous Methods (Only Concepts & Uses): Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micro piles.</p>			

Course Outcomes: After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Purushothama Raj P, “Ground Improvement Techniques”, Laxmi Publications, New Delhi.
2. Koerner R.M, “Construction and Geotechnical Method in Foundation Engineering”, Mc Graw Hill Pub. Co.

Reference Books:

1. Manfred Hausmann , “Engineering principles of ground modification”, Mc Graw Hill Pub. Co.,
2. Bell, F.G., “Methods of treatment of unstable ground”, Butterworths, London.
3. Nelson J.D. and Miller D.J, “Expansive soils”, John Wiley and Sons.
4. Ingles. C.G. and Metcalf J.B , “Soil Stabilization; Principles and Practice”, Butterworths

Course Title: WATER RESOURCES MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI

Subject Code	17CV661	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03		Total Marks-100	
<p>Course objectives: This course will enable students to;</p> <ol style="list-style-type: none"> 1. Judge surface and ground water resources. 2. Address the issues of water resources management. 3. Learn the principles of integrated water resources management. 4. Understand the legal framework of water policy. 5. Know the different methods of water harvesting. 			
Module -1			
<p>Surface and Ground water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Surface Water Resources, Water Balance, Available Renewable Water Resources, Water Scarcity, The Water Balance as a Result of Human Interference, Groundwater Resources, Types of Aquifers, Groundwater as a Storage Medium</p> <p align="right">L2, L3</p>			
Module -2			
<p>Water Resources Planning and Management: Necessity, System components, planning scales, Approaches, planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.</p> <p align="right">L2, L3</p>			
Module -3			
<p>Integrated Water Resources Management: Definition of IWRM, Principles, Implementation of IWRM, Legislative and Organizational Framework, Types and Forms of Private Sector Involvement.</p> <p align="right">L3, L4</p>			
Module -4			
<p>Water Governance and Water Policy: Legal Framework of Water – Substance of National Water Laws – Other key issues – Changing incentives through Regulation - National Water Policy – National-Level Commissions – Irrigation Management Transfer Policies and Activities – Legal Registration of WUAs – Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations – Water Policy Reforms: India.</p> <p align="right">L2, L3</p>			
Module -5			
<p>Water Harvesting and Conservation: Water Harvesting Techniques – Micro-catchments - Design of Small Water Harvesting Structures – Farm Ponds – Percolation Tanks – Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area.</p> <p align="right">L2, L3</p>			
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Assess the potential of groundwater and surface water resources. 2. Address the issues related to planning and management of water resources. 3. Know how to implement IWRM in different regions. 			

4. Understand the legal issues of water policy.
5. Select the method for water harvesting based on the area.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
3. Daniel P. Loucks and Eelco van Beek, "Water Resources Systems. Planning and Management", UNESCO Publication.
4. Mollinga, P. et al, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
5. Singh, Chhatrapati "Water Rights in India," Ed: Chhatrapati Singh. Water Law in India: The Indian Law Institute, New Delhi, 1992.
6. 6) Dhruva Narayana, G. Sastry, V. S. Patnaik, "Watershed Management", CSWCTRI, Dehradun, ICAR Publications, 1997.

Reference Books:

1. Lal, Ruttan. "Integrated Watershed Management in the Global Ecosystem". CRC Press, New York.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. 1988. John Wiley and Sons, Inc., New York.

Course Title: SOFTWARE APPLICATION LAB As per Choice Based Credit System (CBCS) scheme] SEMESTER:VI			
Subject Code	17CVL67	IA Marks	40
Number of Lecture Hours/Week	1I+2P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS –02		Total Marks- 100	
<p>Course objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Use industry standard software in a professional set up. 2. understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design 3. Develop customized automation tools 			
Module -1			
<p>Use of civil engineering softwares: Use of softwares for:</p> <ol style="list-style-type: none"> 1. Analysis of plane trusses, continuous beams, portal frames 2. 3D analysis of multistoried frame structures <p style="text-align: right;">L1,L2,L3</p>			
Module -2			
<p>1. Project Management- Exercise on Project planning and scheduling of a building project using any project management software:</p> <ol style="list-style-type: none"> a. Understanding basic features of Project management software b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software. c. Identification of Predecessor and Successor activities with constrain d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats. e. Study on various View options available f. Basic understanding about Resource Creation and allocation g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project (9hrs) <p>1. GIS applications using open source software:</p> <ol style="list-style-type: none"> a. To create shape files for point, line and polygon features with a map as reference. b. To create decision maps for specific purpose. (3hrs) <p style="text-align: right;">L1,L2,L3</p>			
Module -3			
<p>Use of EXCEL spread sheets: Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation</p> <p style="text-align: right;">L1,L2,L3</p>			
<p>Course Outcomes: After studying this course, students will be able to: use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work</p>			
<p>Program Objectives:</p> <ul style="list-style-type: none"> • Engineering knowledge • Problem analysis • Interpretation of data 			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 3 modules comprising of 6 questions. • There will be two full questions (with a maximum of three subdivisions, if necessary) from each module. • Each full question shall cover the topics as a module • Module-1: 40 Marks, Module-2: 20 Marks, Module-3: 20 Marks 			

- The students shall answer three full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Reference Books: Training manuals and User manuals and Relevant course reference books

**Course Title: EXTENSIVE SURVEY PROJECT /CAMP
As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VI**

Subject Code	17CVL68	IA Marks	40
Number of Practice Hours/Week	04	Exam Marks	60
Total Number of Practice Hours	50	Exam Hours	03
CREDITS -02		Total Marks- 100	

Course objectives: This course will enable students to

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipments.
3. Work in teams and learn time management, communication and presentation skills

- To be conducted between 5th & 6th Semester for a period of 2 weeks including training on total station.
- Viva voce conducted along with 6th semester exams
- An extensive project preparation training involving investigation, collection of data is to be conducted. **Use of Total Station is compulsory for minimum of TWO projects.**
- The student shall submit a project report consisting of designs and drawings.
- Drawings should be done using CAD and survey work using total station
- Students should learn data download from total station, generation of contours, block leveling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant softwares
- The course coordinators should give exposure and simulate activities to achieve the course outcomes

1. **NEW TANK PROJECTS:** The work shall consist of;
 - a. Reconnaissance survey for selection of site and conceptualization of project.
 - b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
 - c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
 - d. Design and preparation of drawing with report.

2. **WATER SUPPLY AND SANITARY PROJECT:** The work shall consist of;
 - a. Reconnaissance survey for selection of site and conceptualization of project.
 - b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
 - c. Preparation of village map by using total station.
 - d. Survey work required for laying of water supply and UGD
 - e. Location of sites for water tank. Selection of type of water tank to be provided. (ground level, overhead and underground)
 - f. Design of all elements and preparation of drawing with report.

3. **HIGHWAY PROJECT:** The work shall consist of;
 - a. Reconnaissance survey for selection of site and conceptualization of project.
 - b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
 - c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
 - d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

4. **RESTORATION OF AN EXISTING TANK:** The work shall consist of;
- Reconnaissance survey for selection of site and conceptualization of project.
 - Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.
 - Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
 - Design of all elements and preparation of drawing with report.

5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;
- Reconnaissance survey for selection of site and conceptualization of project.
 - Detailed survey required for project execution like contour surveys
 - Preparation of layout plans as per regulations
 - Centerline marking-transfer of centre lines from plan to ground
 - Design of all elements and preparation of drawing with report as per regulations

Course outcomes: After studying this course, students will be able to:

- Apply Surveying knowledge and tools effectively for the projects
- Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioral competencies.
- Application of individual effectiveness skills in team and organizational context, goal setting, time management, communication and presentation skills.
- Professional etiquettes at workplace, meeting and general
- Establishing trust based relationships in teams & organizational environment
- Orientation towards conflicts in team and organizational environment, Understanding sources of conflicts, Conflict resolution styles and techniques

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Reference Books:

Training manuals and User manuals
Relevant course reference books

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

7th Semester

Course Title: MUNICIPAL AND INDUSTRIAL WASTE WATER ENGINEERING**As per Choice Based Credit System (CBCS) scheme]****SEMESTER:VII**

Subject Code	17CV71	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	

Course objectives: This course will enable students to;

4. Understand sewerage network and influencing parameters.
5. Understand and design different unit operations involved in conventional and biological treatment process.
6. Apply the principles of Industrial effluent treatment process for different industrial wastes.
7. Evaluate self purification of streams depending on hydraulic and organic loading of sewage into receiving waters.

Module -1

Introduction, need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors effecting dry and wet weather flow on design of sewerage system, estimation of storm flow, time of concentration flow, material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers. low-cost waste treatment; oxidation pond, septic tank, Sewer appurtenances, manholes, catch basins, basic principles of house drainage, typical layout plan showing house drainage connections,

L1,L2**Module -2**

Design of sewers, hydraulic formula for velocity, effects of variation on velocity, regime velocity, design of hydraulic elements for circular sewers for full flow and partial flow conditions, disposal of effluents by dilution, self purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents, Streeter-Phelps equation

L2,L3**Module -3**

Waste water characteristics, sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water treatment, unit operations; screens, grit chambers, skimming tanks, equalization tanks

Suspended growth and fixed film bio process, design of trickling filters, activated sludge process, sequential batch reactors, moving bed bio reactors, sludge digesters,

L1,L2,L3**Module -4**

Difference between domestic and industrial waste water, effect of effluent discharge on streams, methods of industrial waste water treatment; volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of organic, inorganic and colloidal solids, combined treatment methods; merits, demerits and feasibility, principles of discharge of raw, partially treated and completely treated wastes in to streams

L1,L2

Module -5

Process flow chart, sources and characteristics of industrial waste water, treatment methods, reuse and recovery and disposal; cotton and textile industry, tanning industry, cane sugar and distilleries, dairy industry, steel and cement industry, paper and pulp industry, pharmaceutical and food processing industry.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

4. Acquires capability to design sewer and Sewerage treatment plant.
5. Evaluate degree of treatment and type of treatment for disposal, reuse and recycle.
6. Identify waste streams and design the industrial waste water treatment plant.
7. Manage sewage and industrial effluent issues.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Metcalf and Eddy, "Wastewater Engineering - Collection, Treatment, Disposal and Reuse", McGraw Hill Pub.Co., 2009.
2. Nelson Leonard Nemerow, "Industrial Waste Treatment", Butterworth-Heinemann, 2007.
3. Patwardhan A.D, "Industrial Waste Water Treatment", PHI Learning Private Limited- New Delhi
4. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India

Reference Books:

1. Manual on Waste Water Treatment: CPHEEO, Ministry of Urban Development, New Delhi.
2. Fair, Geyer and Okun , "Water and Wastewater Engineering" Vol-II, John Willey Publishers, New York.

Course Title: DESIGN OF RCC AND STEEL STRUCTURES

As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VII

Subject Code	17CV72	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	

Course objectives: This course will enable students to

6. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures
7. Identify, formulate and solve engineering problems in RC and Steel Structures
8. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.
9. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.
10. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.

Module -1

Footings: Design of rectangular slab type combined footing.

Retaining Walls: Design of cantilever Retaining wall and counter fort retaining wall.

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base).
Design of rectangular water tanks resting on ground. **As per IS: 3370 (Part IV)**

Design of portal frames with fixed and hinged based supports.

L1,L2,L3

Module -2

Roof Truss: Design of roof truss for different cases of loading, forces in members to given.

Plate Girder: Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks

Gantry Girder: Design of gantry girder with all necessary checks

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

6. Students will acquire the basic knowledge in design of RCC and Steel Structures.
7. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.
 - One full question should be answered from each module.
 - Each question carries 40 marks.
3. Code books – IS 456, IS 800, IS 3370 (Part IV), SP (6) – Steel Tables, shall be referred for designing
 4. The above charts shall be provided during examinations

Text Books:

4. N Krishna Raju, **“Structural Design and Drawing of Reinforced Concrete and Steel”**, University Press
5. Subramanian N, **“Design of Steel Structures”**, Oxford university Press, New Delhi
6. K S Duggal, **“Design of Steel Structures”**, Tata McGraw Hill, New Delhi

Reference Books:

6. Charles E Salman, Johnson & Mathas, **“Steel Structure Design and Behaviour”**, Pearson Publications
7. Nether Cot, et.al, **“Behaviour and Design of Steel Structures to EC -III”**, CRC Press
8. P C Verghese, **“Limit State Design of Reinforced Concrete”**, PHI Publications, New Delhi
9. S N Sinha, **“Reinforced Concrete Design”**, McGraw Hill Publication

Course Title: HYDROLOGY AND IRRIGATION ENGINEERING**[As per Choice Based Credit System (CBCS) scheme]****SEMESTER:VII**

Subject Code	17CV73	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04		Total Marks-100	

Course Objectives: This course will enable students to;

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

Module -1

Hydrology: Introduction, Importance of hydrology, Global and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

L2, L3**Module -2**

Losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation,

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

L2, L3**Module -3**

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.

Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations

L2, L4

Module -4

Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation.
Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

L2, L4

Module -5

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method.
Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

L2, L4

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Find the benefits and ill-effects of irrigation.
5. Find the quantity of irrigation water and frequency of irrigation for various crops.
6. Find the canal capacity, design the canal and compute the reservoir capacity.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

- 1) K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
- 2) Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
- 3) Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"- . Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications,

New Delhi.

Course Title: GROUND WATER & HYDRAULICS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER:VII

Subject Code	17CV742	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03		Total Marks-100	
<p>Course objectives: This course will enable students</p> <ul style="list-style-type: none"> • To characterize the properties of ground water and aquifers. • To quantify the ground water flow. • To locate occurrence of ground water and augment ground water resources. • To synthesize ground water development methods. 			
Module -1			
<p>Introduction: Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.</p> <p style="text-align: right;">L1, L2</p>			
Module -2			
<p>Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, unisotropic layered soils, steady one dimensional flow: cases with recharge.</p> <p style="text-align: right;">L2, L3</p>			
Module -3			
<p>Well Hydraulics: Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; theis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory.</p> <p style="text-align: right;">L2, L3, L4</p>			
Module -4			
<p>Ground Water Exploration: Seismic method, electrical resistivity method, Geophysical techniques, electrical logging, radioactive logging, induction logging, sonic and</p>			

fluid logging.	L2, L3
Module -5	
<p>Ground Water Development: Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.</p> <p>Ground Water Recharge: Artificial recharge, groundwater runoff</p>	
L2, L3	
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Find the characteristics of aquifers. • Estimate the quantity of ground water by various methods. • Locate the zones of ground water resources. • Select particular type of well and augment the ground water storage. 	
<p>Program Objectives:</p> <ol style="list-style-type: none"> 3. Engineering knowledge 4. Problem analysis 5. Interpretation of data 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi. 2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi. 3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi. 2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi. 3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi. 	

Course Title: REHABILITATION AND RETROFITTING OF STRUCTURES			
As per Choice Based Credit System (CBCS) scheme]			
SEMESTER:VII			
Subject Code	17CV753	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS -03		Total Marks- 100	
<p>Course Objectives: This course will enable students to;</p> <ul style="list-style-type: none"> • Investigate the cause of deterioration of concrete structures. • Strategise different repair and rehabilitation of structures. • Evaluate the performance of the materials for repair 			
Module -1			
<p>General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.</p>			
L1,L2			
Module -2			
<p>Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems</p>			
L1,L2			
Module -3			
<p>Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.</p>			
L1,L2,L3			
Module -4			
<p>Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building</p>			
L1,L2,L3			
Module -5			

Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Course Title: ENVIRONMENTAL ENGINEERING LABORATORY**As per Choice Based Credit System (CBCS) scheme****SEMESTER:VII**

Subject Code	17CVL76	IA Marks	40
Number of Lecture Hours/Week	1I+2P	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS -02		Total Marks- 100	

Course objectives: This course will enable students,

1. To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice

Revised Bloom's Taxonomy (RBT) Level**L1,L2,L3**

1. Determination of pH, Acidity and Alkalinity
2. Determination of Calcium, Magnesium and Total Hardness.
3. Determination of Dissolved Oxygen.
4. Determination of BOD.
5. Determination of Chlorides
6. Determination of percentage of available chlorine in bleaching powder,
7. Determination of Residual Chlorine
8. Determination of Solids in Sewage:
 - I) Total Solids,
 - II) Suspended Solids,
 - III) Dissolved Solids,
 - IV) Volatile Solids, Fixed Solids,
 - V) Settle able Solids.
9. Determination of Turbidity by Nephelometer
10. Determination of Optimum Dosage of Alum using Jar test apparatus.
11. Determination of sodium and potassium using flame photometer.
12. Determination Nitrates by spectrophotometer.
13. Determination of Iron & Manganese.
14. Determination of COD. (Demonstration)
15. Air Quality Monitoring (Ambient, stack monitoring, Indoor air pollution) (Demonstration)
16. Determination of Sound by Sound level meter at different location (Demonstration)

Course Outcomes: After studying this course, students will be able to:

1. Acquire capability to conduct experiments and estimate the concentration of different parameters.
2. Compare the result with standards and discuss based on the purpose of analysis.

3. Determine type of treatment, degree of treatment for water and waste water.
4. Identify the parameter to be analyzed for the student project work in environmental stream.

Program Objectives:

1. Evaluation of the test results and assesses the impact on water and waste water treatment.
2. Train student to undertake student project work in 8th semester in the field of environmental engineering.

Question paper pattern:

1. Two experiments shall be asked from the above set
2. One experiment to be conducted and for the other student should write detailed procedure.

Reference Books:

1. Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal
2. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science", McGraw-Hill Series in Civil and Environmental Engineering

Course Title: COMPUTER AIDED DETAILING OF STRUCTURES**As per Choice Based Credit System (CBCS) scheme]****SEMESTER:VII**

Subject Code	17CVL77	IA Marks	40
Number of Lecture Hours/Week	03 (1I+2D)	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS -02		Total Marks- 100	

Course objectives: This course will enable students to

- Be aware of the Scale Factors, Sections of drawings,
- Draft the detailing of RC and Steel Structural member.

RBT LEVEL**L1,L2,L3****Module -1 Detailing of RCC Structures**

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

Module -2 Detailing of Steel Structures

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Beams with Bolted and Welded
6. Gantry Girder

Course outcomes: After studying this course, students will be able to:

4. Prepare detailed working drawings

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question paper pattern:

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 40 marks.

Text Books:

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

Reference Books:

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards
2. IS 13920:2016, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD
BE-CBCS SYLLABUS 2017-18 Scheme

8th Semester

Course Title: QUANTITY SURVEYING AND CONTRACTS MANAGEMENT As per Choice Based Credit System (CBCS) scheme SEMESTER:VIII			
Subject Code	17CV81	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	
<p>Course objectives: This course will enable students to;</p> <ol style="list-style-type: none"> 1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project 2. Understand and apply the concept of Valuation for Properties 3. Understand, Apply and Create the Tender and Contract document. 			
Module -1			
<p>Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method.</p> <p>Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.</p> <p style="text-align: right;">L2,L3</p>			
Module -2			
<p>Estimate of Steel truss, manhole and septic tanks.</p> <p>Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -3			
<p>Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings,</p> <p>Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost</p> <p>Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.</p> <p style="text-align: right;">L1,L2,L3</p>			
Module-4			
<p>Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).</p> <p>Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting.</p> <p>Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC</p> <p style="text-align: right;">L1,L2,L3</p>			
Module -5			
<p>Contract Management-Post award :Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration</p> <p>Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation,</p>			

valuation for mortgage, valuation of land.

L1,L2,L3

Course outcomes: After studying this course, students will be able to:

1. Prepare detailed and abstract estimates for roads and building.
2. Prepare valuation reports of buildings.
3. Interpret Contract documents of domestic and international construction works

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press
3. M. Chakraborti; "Estimation, Costing and Specifications", Laxmi Publications
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi

Reference Books:

1. Kohli D.D and Kohli R.C, "Estimating and Costing", 12th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge, "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy, Garold D. Oberlender, "Estimating Construction Costs" – 5ed, Tata McGraw-Hill, New Delhi
7. David Pratt, "Fundamentals of Construction Estimating" – 3ed,
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka
9. FIDIC Contract forms
10. B.S. Ramaswamy "Contracts and their Management" 3ed, Lexis Nexis (a division of Reed Elsevier India Pvt Ltd)

Course Title: DESIGN OF PRE STRESSED CONCRETE ELEMENTS As per Choice Based Credit System (CBCS) scheme] SEMESTER:VIII			
Subject Code	17CV82	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS -04		Total Marks- 100	
Course objectives: This course will enable students to learn Design of Pre Stressed Concrete Elements			
Module -1			
Introduction and Analysis of Members: Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete. Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete - prestressed concrete - Force concept - Load balancing concept - Kern point - Pressure line. L1,L2			
Module -2			
Losses in Prestress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss. Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width. L1,L2			
Module -3			
Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members L1,L2,L3			
Module -4			
Design for Shear: Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement. L1,L2,L3			
Module -5			
Composite Sections: Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections. L1,L2,L3			
Course outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Understand the requirement of PSC members for present scenario. • Analyse the stresses encountered in PSC element during transfer and at working. • Understand the effectiveness of the design of PSC after studying losses • Capable of analyzing the PSC element and finding its efficiency. • Design PSC beam for different requirements. 			

Course Title: PAVEMENT DESIGN As per Choice Based Credit System (CBCS) scheme] SEMESTER:VIII			
Subject Code	17CV833	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS -03		Total Marks- 100	
<p>Course objectives: This course will enable students to</p> <ol style="list-style-type: none"> 1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement. 2. Excel in the path of analysis of stress, strain and deflection in pavement. 3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002 4. Understand the various causes leading to failure of pavement and remedies for the same. 5. Develop skills to perform functional and structural evaluation of pavement by suitable methods. 			
Module -1			
<p>Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement</p> <p>Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above</p> <p style="text-align: right;">L2, L3,L4</p>			
Module -2			
<p>Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.</p> <p>Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above</p> <p style="text-align: right;">L5,L6</p>			
Module -3			
<p>Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for</p> <p>Airfield pavement and problems on above</p> <p style="text-align: right;">L4,L5</p>			
Module -4			
<p>Stresses in Rigid Pavement : Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above</p> <p>Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above</p> <p style="text-align: right;">L4,L5,L6</p>			
Module -5			

Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of subgrade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

L4,L5

Course outcomes: After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, burmister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Text Books:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

Reference Books:

1. Yoder & wit zorac , "Principles of pavement design", John Wiley & Sons.
2. Subha Rao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design" , University Press.
4. Relevant recent IRC codes

Course Title: INTERNSHIP /PROFESSIONAL PRACTICE As per Choice Based Credit System (CBCS) scheme] SEMESTER:VIII			
Subject Code	17CV84	IA Marks	50
Number of Lecture Hours/Week	Industry Oriented	Exam Marks	50
Total Number of Lecture Hours	Industry Oriented	Exam Hours	03
CREDITS -02		Total Marks- 100	
Course objectives: This course will enable students to get the field exposure and experience			
Note: Internship /Professional Practice:			
<ol style="list-style-type: none"> 1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organisations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions. 2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions 3. The industry/organisation should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship. 4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate. 5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute. 6. The College shall facilitate and monitor the student internship program. 7. The internship should be completed during vacation after VI and VII semesters. 			

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

III SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. / Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT31	Engg. Maths – III	Mathematics	04	--	03	25	100	125
2	10ME32A/10ME32B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME33	Basic Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME34	Mechanics of Materials	Mechanical	04	--	03	25	100	125
5	10ME35	Manufacturing Process I	Mechanical	04	--	03	25	100	125
6	10ME36A/10ME36B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL37A/10MEL37B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL38A/10MEL38B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
III SEMESTER B.E. MECHANICAL				21/24	9	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

IV SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT41	Engg. Maths – IV	Mathematics	04	--	03	25	100	125
2	10ME42A/10ME42B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME43	Applied Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME44	Kinematics of Machines	Mechanical	04	--	03	25	100	125
5	10ME45	Manufacturing Process II	Mechanical	04	--	03	25	100	125
6	10ME46A/10ME46B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL47A/10MEL47B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL48A/10MEL48B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
				21	09	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME51	Management and Entrepreneurship	04	--	03	25	100	125
2	10ME52	Design of Machine Elements I	04	--	03	25	100	125
3	10ME53	Energy Engineering	04	--	03	25	100	125
4	10ME54	Dynamics of Machines	04	--	03	25	100	125
5	10ME55	Manufacturing Process III	04	--	03	25	100	125
6	10ME56	Turbo Machines	04	--	03	25	100	125
7	10MEL57	Fluid Mechanics & Machines Lab	--	03	03	25	50	75
8	10MEL58	Energy Conversion Engg. Lab		03	03	25	50	75
			24	06	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME61	Computer Integrated Manufacturing	04	--	03	25	100	125
2	10ME62	Design of Machine Elements II	04	--	03	25	100	125
3	10ME63	Heat & Mass Transfer	04	--	03	25	100	125
4	10ME64	Finite Element Methods	04	--	03	25	100	125
5	10ME65	Mechatronics & □ P	04	--	03	25	100	125
6	10ME66X	Elective 'A'	04	--	03	25	100	125
7	10MEL67	Heat & Mass Transfer Lab	--	03	03	25	50	75
8	10MEL68	CAMA Lab	--	03	03	25	50	75
			24	06	24	200	700	900

Elective 'A'	
10ME663 Refrigeration & Air Conditioning	
10ME665 Non Traditional Machining	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME71	Engineering Economics	04	--	03	25	100	125
2	10ME72	Mechanical Vibrations	04	--	03	25	100	125
3	10ME73	Hydraulics and Pneumatics	04	--	03	25	100	125
4	10ME74	Operations Research	04	--	03	25	100	125
5	10ME75X	Elective B	04	--	03	25	100	125
6	10ME76X	Elective C	04	--	03	25	100	125
7	10MEL77	Design Lab	--	03	03	25	50	75
8	10MEL78	CIM and Automation Lab	--	03	03	25	50	75
9	10MEL79	Project Phase I	--	--	--	50	--	50
			24	06	24	250	700	950

Elective 'B'	Elective 'C'
10ME754 Non Conventional Energy Sources	10ME761 Experimental Stress Analysis
10ME758 Total Quality Management	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME81	Operations Management	04	--	03	25	100	125
2	10ME82	Control Engineering	04	--	03	25	100	125
3	10ME83X	Elective D	04	--	03	25	100	125
4	10ME84X	Elective E	04	--	03	25	100	125
5	10ME85L	Project Work	--	06	03	100	100	200
6	10ME86L	Seminar	--	03	--	50	--	50
				09	15	250	500	750

Elective 'D'	Elective 'E'
10ME831 Tribology	10ME844Automotive Engineering
10ME833 Power Plant Engineering	
10ME838 Foundry Technology	

III Semester
MATERIAL SCIENCE AND METALLURGY

Sub Code	: 10ME 32A /42A	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT - 2

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT - 3

Fracture: Type I, Type II and Type III.

Creep: Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

07 Hours

UNIT - 4

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT - 5

Phase Diagram II: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT - 6

Heat treating of metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT - 7

Ferrous and non ferrous materials: Properties, Composition and uses of

- Grey cast iron, malleable iron, SG iron and steel
- Copper alloys-brasses and bronzes.
Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT - 8

Composite Materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering**, Smith, 4th Edition McGraw Hill, 2009
2. **Materials Science, Shackelford., & M. K. Muralidhara**, Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An Introduction to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering**, V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering**, H. VanVlack, Addison-Wesley Edn., 1998
6. **Materials Science and Engineering**,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition,2001.
7. **The Science and Engineering of Materials**, Donald R. Asklund and Pradeep.P. Phule, Cengage Learning, 4th Ed.,2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	: 10ME 32B / 42B	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT-1:

Standards of measurement: Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2:

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3:

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4:

Interferometer and screw thread, gear measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 - wire and 3 - wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5:

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

UNIT-6:

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

UNIT-7:

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

UNIT-8:

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements**, R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation**, Alstuko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5th Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A.

BASIC THERMODYNAMICS

(Common to ME/IP/AU/IM/MA)

Sub Code	: 10ME33	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT- 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT- 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT- 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B

UNIT- 5

Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT- 6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT- 7

Thermodynamic relations: Maxwell relation, Clausius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT- 8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart

06 Hours

Data Handbooks :

1. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:

1. **Basic Engineering Thermodynamics**, A.Venkatesh, University Press, 2008
2. **Basic and Applied Thermodynamics**, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamics**, An Engineering Approach, Yunus A.Cengel and Michael A.Boles, Tata McGraw Hill publications, 2002
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Classical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamics**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics**, PHI, New Delhi, 2010

MECHANICS OF MATERIALS

Sub Code	: 10ME34	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks:	100

PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3:

Compound Stresses: Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods: Work and strain energy, Strain energy in bar/beams, Castigliano's theorem, Energy methods.

Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lamé's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5:

Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6:

Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / notched beams not included).

07 Hours

UNIT 7:

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:

Torsion of Circular Shafts and Elastic Stability of Columns :

Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. "**Mechanics of Materials**", by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2005
2. "**Mechanics of materials**", James.M.Gere, Thomson, Fifth edition 2004.
3. "**Mechanics of materials**", in SI Units, Ferdinand Beer & Russell Johnston, 5th Ed., TATA McGraw Hill- 2003.

REFERENCE BOOKS:

1. "**Strength of Materials**", S.S. Rattan, Tata McGraw Hill, 2009
2. "**Strength of Materials**", S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. "**Mechanics of Materials**", K.V. Rao, G.C. Raju, First Edition, 2007
4. "**Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. "**Strength of Materials**", W.A. Nash, 5th Ed., Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

(FUNDAMENTALS OF FOUNDRY & WELDING)

Sub Code	: 10ME35	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

CASTING PROCESS

UNIT 1

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.
Additives: Need, Types of additives used and their properties..

06 Hours

UNIT 2

Sand Moulding : Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO₂ mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

07 Hours

UNIT 4

Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding (**MAW**), Flux Shielded Metal Arc Welding (**FSMAW**), Inert Gas Welding (**TIG & MIG**) Submerged Arc Welding (**SAW**) and Atomic Hydrogen Welding processes. (**AHW**)

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07

Hours

UNIT 6

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7

Metallurgical aspect, in welding : Structure of welds, Formation of different zones during welding. Heat affected zone (**HAZ**). Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8

Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. “**Manufacturing Process-I**”, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. “**Manufacturing & Technology: Foundry Forming and Welding**”, P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. “**Process and Materials of Manufacturing**”, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. “**Manufacturing Technology**”, Serope Kalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code	: 10ME36A / 10ME46A	IA Marks	: 25
Hrs/week	: 04(1 Hrs. Theory & 2 Hrs Practical)	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

02 Hours

PART-A

UNIT 1:

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

08 Hours

UNIT 2:

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

08 Hours

PART-B

UNIT 3:

Keys & Joints :

Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

08 Hours

UNIT 4:

Couplings:

Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

08 Hours

PART - C

Assembly Drawings

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool Head of a shaper

18 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat & V.M.Panchal

REFERENCE BOOKS:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.
3. 'Machine Drawing with Auto CAD', Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
4. 'Auto CAD 2006, for engineers and designers', Sham Tickoo. Dream tech 2005
5. 'Machine Drawing', N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill,2006

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e. PART-A	1 x 20 = 20 Marks
PART-B	1 x 20 = 20 Marks
PART-C	1 x 60 = 60 Marks
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Total	= 100 Marks

FLUID MECHANICS

Sub Code	: 10ME 36B / 46B	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	100

PART – A

UNIT-1

Properties of Fluids: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2

Fluid Statics : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3

Buoyancy and Fluid Kinematics:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.

Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5

Fluid Flow Measurements : Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similitudes.

07 Hours

UNIT-6

Flow through pipes : Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

06 Hours

UNIT-7

Laminar flow and viscous effects : Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseuille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.

Introduction to compressible flow : Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. **Fluid Mechanics**, Ojush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. **Fluid Mechanics**, Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. **Fluid Mechanics and hydraulics**, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. **Fluid Mechanics (SI Units)**, Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics**, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
5. **Fluid Mechanics** - . Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	: 10MEL 37A / 47A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
 - (a). Ultrasonic flaw detection
 - (b). Magnetic crack detection
 - (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S, C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	: 10MEL 37B / 47B	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

FOUNDRY AND FORGING LABORATORY

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

- 1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
- 2 Permeability test
- 3 Core hardness & Mould hardness tests.
- 4 Sieve Analysis to find Grain Finest number of Base Sand
- 5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.

Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations :

- Calculation of length of the raw material required to do the model.

- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks
Calculation (Forging)	+ Forging Model	= 05 +25 = 30 Marks

Viva-Voce : 10 marks.

Total : 50 Marks.

MACHINE SHOP

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

ONE question from part -A: 30 Marks

ONE question from part -B: 10 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

APPLIED THERMODYNAMICS

Sub Code	: 10ME43	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

Unit 1:

Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

Unit 2:

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

Unit 3:

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

Unit 4:

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5:

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work,

optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6:

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8

Psychrometry: Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :

1. **Thermodynamic data hand book**, B.T.Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkahna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,

2. **Fundamental of Classical Thermodynamics**, G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Sub Code	: 10ME44	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1:

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2:

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3:

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5:

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods):

Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6:

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines"**, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II

(Metal Removing Process)

Sub Code	: 10ME45	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT - 1

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07

Hours

UNIT - 2

Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3

Turning (Lathe), Shaping and Planing Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations

07 Hours

UNIT - 4

Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials. Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology**, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology**, R.K.Jain, Khanna Publications, 2003.
3. **Production Technology**, HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools**, G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	: 10AL 51	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co - Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINE ELEMENTS-I

Sub Code	: 10ME 52	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT- 1

Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

05 Hours

UNIT- 2

Design For Static & Impact Strength:

Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

07 Hours

UNIT - 3

Design For Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

08 Hours

UNIT - 4

Threaded Fasteners: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

06 Hours

PART - B

UNIT - 5

Design Of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

07 Hours

UNIT - 6

Cotter And Knuckle Joints, Keys And Couplings: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and

flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

07 Hours

UNIT - 7

Riveted and Welded Joints – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

07 Hours

UNIT - 8

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

05 Hours

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2009.
2. **Design of Machine Elements**, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

DESIGN DATA HANDBOOK

1. **Design Data Hand Book**, K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design**, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

ENERGY ENGINEERING

Sub Code	: 10ME 53	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures.

07 Hours

UNIT - 2

A Brief Account Of Benson, Velox Schmidt Steam Generators. Chimneys: Natural, forced, induced and balanced draft, Calculations and numericals involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air pre-heaters and re-heaters.

07 Hours

UNIT - 3

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

06 Hours

UNIT - 4

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numericals. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

06 Hours

PART - B

UNIT - 5

Nuclear Power Plant: Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste disposal.

06 Hours

UNIT - 6

Solar Energy: Solar Extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples).

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

08 Hours**UNIT - 7**

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC.

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy.

06 Hours**UNIT - 8**

Energy From Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation.

Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, classification of bio gas plants, factors affecting bio gas generation.

Thermo Chemical Route: Thermo chemical conversion on bio mass, types of gasifiers.

06 Hours**TEXT BOOKS:**

1. **Power Plant Engineering**, P. K. Nag Tata McGraw Hill 2nd edn 2001.
2. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons. 2003

REFERENCE BOOKS:

1. **Power Plant Engineering**, R. K. Rajput, Laxmi publication, New Delhi.
2. **Principles of Energy conversion**, A. W. Culp Jr., McGraw Hill. 1996

3. **Non conventional Energy sources**, G D Rai Khanna Publishers.
4. **Non conventional resources**, B H Khan TMH - 2007

DYNAMICS OF MACHINES

Sub Code	: 10ME 54	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1: Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

06 Hours

UNIT 2: Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

08 Hours

UNIT 3: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. ratio of belt tensions, centrifugal tension, power transmitted.

06 Hours

UNIT 4: Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

06 Hours

PART - B

UNIT 5: Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

08 Hours

UNIT 6: Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force. stability, sensitiveness. Isochronism, effort and power,

06 Hours

UNIT 7: Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

06 Hours

UNIT 8: Analysis of Cams: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers. Undercutting in Cams

06 Hours

TEXT BOOKS:

1. **Theory of Machines**, Sadhu Singh, Pearson Education. 2nd edition. 2007.
2. **Theory of Machines**, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009
2. **Mechanism and Machine Theory**, A.G.Ambekar PHI, 2007

MANUFACTURING PROCESS – III

(METAL FORMING PROCESS)

Sub Code	: 10ME 55	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction And Concepts: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain.

07 Hours

UNIT - 2

Effects Of Parameters: Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

06 Hours

UNIT - 3

Forging: Classification of forging processes. Forging machines & equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Simple problems.

07 Hours**UNIT - 4**

Rolling: Classification of Rolling processes. Types of rolling mills, expression for Rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, Effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables, simple problems.

06 Hours**PART - B****UNIT - 5**

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing, simple problems.

07 Hours**UNIT - 6**

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, simple problem

06 Hours**UNIT - 7**

Sheet & Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring, Simple problems

06 Hours**UNIT - 8**

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

07 Hours**TEXT BOOKS:**

1. **Mechanical metallurgy (SI units)**, G.E. Dieter, Mc Graw Hill pub.2001
2. **Manufacturing Process – III**, Dr. K.Radhakrishna, Sapna Book House, 2009.

REFERENCE BOOKS:

1. **Materials and Processes in Manufacturing**, E.paul, Degramo, J.T. Black, Ronald, A.K. Prentice -hall of India 2002
2. **Principles of Industrial metal working process**, G.W. Rowe, CBSpub. 2002
3. **Manufacturing Science**, Amitabha Ghosh & A.K. Malik - East - Westpress 2001
4. **Technology of Metal Forming Process**, Surendra kumar, PHI – 2008

TURBO MACHINES

Sub Code	: 10ME 56	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies. Application of first and second law's of thermodynamics to turbomachines, Efficiencies of turbomachines. Problems.

07 Hours

UNIT – 2

Thermodynamics of fluid flow: Static and Stagnation states- Incompressible fluids and perfect gases, Overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

07 Hours

UNIT – 3

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction,

utilization factor, Relation between degree of reaction and Utilization factor, Problems.

06 Hours

UNIT – 4

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

06 Hours

PART - B

UNIT – 5

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging, Problems.

07 Hours

UNIT – 6

Hydraulic Turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

07 Hours

UNIT – 7

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

06 Hours

UNIT – 8

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

06 Hours

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

TEXT BOOKS:

1. **An Introduction to Energy Conversion**, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. **Turbines, Compressors & Fans**, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. **Principals of Turbomachines**, D. G. Shepherd, The Macmillan Company (1964).
2. **Fluid Mechanics & Thermodynamics of Turbomachines**, S. L. Dixon, Elsevier (2005).
3. **Turbomachine**, B.K.Venkanna PHI, New Delhi 2009.
4. **Text Book of Turbomachines**, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

FLUID MECHANICS AND MACHINES LABORATORY

Sub Code	: 10MEL 57	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of coefficient of friction of flow in a pipe.
2. Determination of minor losses in flow through pipes.
3. Determination of force developed by impact of jets on vanes.
4. Calibration of flow measuring devices
 - a. Orifice Plate meter
 - b. Nozzle
 - c. Venturimeter
 - d. V-notch

18 Hours

PART - B

5. Performance testing of Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
6. Performance testing of Pumps
 - a. Single stage / Multi stage centrifugal pumps
 - b. Reciprocating pump
7. Performance test of a two stage Reciprocating Air Compressor
8. Performance test on an Air Blower

24 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup + 10)
One Question from Part B	-	25 Marks (05 Writeup + 20)
Viva-Voce	-	10 Marks

Total		50 Marks

ENERGY CONVERSION ENGINEERING LABORATORY

Sub Code	: 10MEL 58	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.

4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).
5. Use of planimeter

21 Hours**PART - B**

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for
 - (a) Four stroke Diesel Engine
 - (b) Four stroke Petrol Engine
 - (c) Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - (d) Two stroke Petrol Engine
 - (e) Variable Compression Ratio I.C. Engine.

21 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup+10)
One Question from Part B	-	25 Marks (05 Writeup+20)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER INTEGRATED MANUFACTURING

Sub Code	: 10ME 61	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT - 1

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Transfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

6 Hours

UNIT - 4

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering L above methods and computerized line balancing.

6 Hours

PART-B

UNIT - 5

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly Machine analysis of single station assembly. **Automated Guided Vehicle System:** Introduction,

Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.

6 Hours

UNIT - 7

Cnc Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

6 Hours

UNIT - 8

Robotics: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

2. **Automation, Production system & Computer Integrated manufacturing**, M. P. Groover Person India, 2007 2nd edition.
3. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing**, J. A. Rehg & Henry. W. Kraebber.
2. **CAD/CAM** by Zeid, Tata McGraw Hill.

DESIGN OF MACHINE ELEMENTS – II

Sub Code	: 10ME 62	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Cylinders & Cylinder Heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

08 Hours

UNIT - 2

Belts Ropes and Chains: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

05 Hours**UNIT - 3**

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

08 Hours**UNIT - 4**

Spur & Helical Gears: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

07 Hours**PART - B****UNIT - 5**

Bevel and Worm Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

07 Hours**UNIT - 6**

Clutches & Brakes: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

05 Hours**UNIT - 7**

Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

07 Hours**UNIT - 8**

IC Engine Parts: Design of piston, connecting rod and crank shaft.

05 Hours**DESIGN DATA HANDBOOK**

1. **Design Data Hand Book** , K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication

3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements**, V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007

REFERNCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design**, A CAD Approach: Andrew D DIMAROGONAS, John Wiley Sons, Inc, 2001.

HEAT AND MASS TRANSFER

Sub Code	: 10ME 63	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundry conditions of 1st, 2nd and 3rd Kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.

07 Hours

UNIT - 2

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hours**UNIT - 3**

One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

06 Hours**UNIT - 4**

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

07 Hours**PART - B****UNIT - 5**

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

06 Hours**UNIT - 6**

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hours

UNIT - 7

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion (no numericals).

07 Hours**UNIT - 8**

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hours**TEXT BOOKS:**

1. **Heat & Mass transfer**, Tirumaleshwar, Pearson education 2006
2. **Heat transfer-A basic approach**, Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach**, Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer**, Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer**, Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer**, P.K. Nag, Tata McGraw Hill 2002.

FINITE ELEMENT METHODS

Sub Code	: 10ME 64	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT-1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

UNIT-2

Basic Procedure: Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

UNIT-3

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

UNIT-4

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique.

06 Hrs

PART-B

UNIT-5

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

UNIT-6

Trusses: Stiffness matrix of Truss element. Numerical problems.

06 Hrs

UNIT-7

Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.

06 Hrs

UNIT-8

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs**TEXT BOOKS:**

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

MECHATRONICS & MICROPROCESSOR

Sub Code	: 10ME 65	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

Introduction to Mechatronic Systems: Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours**UNIT - 2**

Review of Transducers and Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours

UNIT 3

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

06 Hours**UNIT - 4**

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation.

07 Hours**PART - B****UNIT - 5**

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

07 Hours**UNIT - 6**

Logic Function: Data word representation. Basic elements of control systems 808SA processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

07 Hours**UNIT - 7**

Organization & Programming of Microprocessors: Introduction to organization of INTEL 808S-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

06 Hours**UNIT - 8**

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

06 Hours

TEXT BOOKS:

1. **Mechatronics**, W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming And Applications With 8085/8085A**, R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics and Microprocessors**, K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran, Wiley, 1st Ed, 2009
2. **Mechatronics - Principles, Concepts and applications** – Nitaigour and Premchand Mahilik - Tata McGraw Hill- 2003.
3. **Mechatronics Principles & applications**, Godfrey C. Onwubolu, Elsevier..
4. **Introduction Mechatronics & Measurement systems**, David.G. Aliciatore & Michael. B. Bihistaned, Tata McGraw Hill, 2000.

HEAT & MASS TRANSFER LABORATORY

Sub Code	: 10MEL 67	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.

21 Hours**PART - B**

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour

4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air - Conditioner
6. Experiment on Transient Conduction Heat Transfer

21 Hours**Scheme for Examination:**

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

Sub Code	: 10MEL 68	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A**Study of a FEA package and modeling stress analysis of**

- a. Bars of constant cross section area, tapered cross section area and stepped bar
6 Hours
- b. Trusses – (Minimum 2 exercises)
3 Hours
- c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc (Minimum 6 exercises)
12 Hours

PART - B

- a) Stress analysis of a rectangular plate with a circular hole
3 Hours
- b) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 4 exercises)
9 Hours

- c) Dynamic Analysis
- 1) Fixed – fixed beam for natural frequency determination
 - 2) Bar subjected to forcing function
 - 3) Fixed – fixed beam subjected to forcing function

9 Hours

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomason, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

ELECTIVE-II (GROUP - A)

REFRIGERATION AND

AIR CONDITIONING

Sub Code	: 10ME 663	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Methods Of Refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration.

06 Hours

UNIT – 2

Gas Cycle Refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages & dis-advantages of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numericals.

06 Hours

UNIT – 3

Multi Pressure Vapour Compression Systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid

carbon dioxide, System practices for multistage system.

07 Hours

UNIT - 4

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures

07 Hours

PART - B

UNIT – 5

Equipments Used In Vapour Compression Refrigeration System: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

06 Hours

UNIT - 6

Vapour Absorption System: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

07 Hours

UNIT - 7

Design Conditions: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

Load Calculations And Applied Psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

07 Hours**UNIT - 8**

Transmission And Distribution Of Air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

Controls In Refrigeration And Air Conditioning Equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

06 Hours**TEXT BOOKS:**

1. **‘Refrigeration and Air-Conditioning’** C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
2. **‘Refrigeration and Air-Conditioning’** W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.
3. **ASHRAE**, Hand Book, 2009

REFERENCE BOOKS:

1. **‘Principles of Refrigeration’** Dossat, Pearson-2006.
2. **„Heating, Ventilation and Air Conditioning’**, McQuiston, Wiley Students edition, 5th edition 2000.
3. **„Air conditioning’** PITA, 4th edition, pearson-2005
4. **‘Refrigeration and Air-Conditioning’** Manohar prasad
5. **‘Refrigeration and Air-Conditioning’** S C Arora & S Domkundwar, Dhanpat Rai Publication

NON-TRADITIONAL MACHINING

Sub Code	: 10ME 665	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.

05 Hours

UNIT - 2

Ultrasonic Machining (Usm): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hours

UNIT - 3

Abrasive Jet Machining (Ajm): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

07 Hours

UNIT - 4

Electrochemical Machining (Ecm): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

06 Hours

PART - B**UNIT - 5**

Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

06 Hours**UNIT - 6**

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

08 Hours**UNIT - 7**

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hours**UNIT - 8**

Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

07 Hours**TEXT BOOKS:**

1. **Modern machining process**, Pandey and Shan, Tata McGraw Hill 2000
2. **New Technology**, Bhattacharya 2000

REFERENCE BOOKS:

1. **Production Technology**, HMT Tata McGraw Hill. 2001

2. **Modern Machining Process**, Aditya. 2002
3. **Non-Conventional Machining**, P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook: Machining Volume 16**, Joseph R. Davis (Editor), American Society of Metals (ASM)

ENGINEERING ECONOMY

Sub Code	: 10ME 71	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3

Equivalent Annual-Worth Comparisons: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4

Rate-Of-Return Calculations And Depreciation: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5

Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6

Introduction, Scope Of Finance, Finance Functions: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7

Financial Ratio Analysis: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

Financial And Profit Planning: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy**, Riggs J.L., 4TH ed. , McGraw Hill, 2002
2. **Engineering Economy**, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy**, Tarachand, 2000.
2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000
3. **Financial Mangement**, Prasanna Chandra, 7th Ed., TMH, 2004
4. **Finacial Management**, IM PANDEY, Vikas Pub. House, 2002

MECHANICAL VIBRATIONS

Sub Code	: 10ME 72	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations**, S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations**, V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications**, W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations**, G. K.Grover, Nem Chand and Bros, 6th edition, 1996.

HYDRAULICS AND PNEUMATICS

Sub Code	: 10ME 73	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double - Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.

Compressed Air: Production of compressed air- Compressors Preparation of compressed air-Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

06 Hours

TEXT BOOKS:

1. **“Fluid Power with Applications”**, Anthony Esposito, Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics'**, Andrew Parr, Jaico Publishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata McGraw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks'** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems'**, S. R. Majumdar, Tata McGraw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

OPERATION RESEARCH

Sub Code	: 10ME 74	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

Solution Of Linear Programming Problems: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

Integer Programming: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

Pert-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

Sequencing: Basic assumptions, sequencing „n“ jobs on single machine using priority rules, sequencing using Johnson“s rule-„n“ jobs on 2 machines, „n“ jobs on 3 machines, „n“ jobs on „m“ machines. Sequencing 2 jobs on „m“ machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research**, P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research**, Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research**, A P Verma, S K Kataria & Sons, 2008
2. **Operations Research**, Paneerselvan, PHI
3. **Operations Research**, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research**, Hillier and Liberman, 8th Ed., McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

DESIGN LABORATORY

Sub Code	: 10MEL 77	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
 - a) Circular disc subjected to diametral compression.
 - b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:

One question from Part A -	20 Marks (05 Write up +15)
One question from Part B -	20 Marks (05 Write up +15)
Viva - Voce -	10 Marks

Total: 50 Marks

CIM & AUTOMATION LAB

Sub Code	: 10MEL 78	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master- CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examination:

Two questions from Part A - 40 Marks (20 Write up +20)
Viva - Voce - 10 Marks

Total: 50 Marks

NON-CONVENTIONAL ENERGY RESOURCE

Sub Code	: 10ME 754	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Subject Code	:	10ME754	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Letter

TOTAL QUALITY MANAGEMENT

Sub Code	: 10ME 758	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction : customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5

Quality Management Tools : Why Why, forced field analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6

Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7

Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Bald ridge, and sis sigma, a view toward the future.

07

Hours

UNIT - 8

Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
2. **100 Methods for Total Quality Management:** Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1
3. **Organisational Excellence through TQM,** H. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)
EXPERIMENTAL STRESS ANALYSIS

Sub Code	: 10ME 761	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

06 Hours

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photo-elasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photo-elasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photo-elastic model materials, Materials for 2D photo-elasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photo-elasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings. **08 Hours**

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. "Experimental Stress Analysis", Dally and Riley, McGraw Hill.
2. "Experimental Stress Analysis". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata McGraw Hill.

REFERENCES BOOKS :

1. "Photoelasticity Vol I and Vol II, M.M.Frocht, John Wiley & sons.
2. "Strain Gauge Primer", Perry and Lissner,
3. "Photo Elastic Stress Analysis", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "Motion Measurement and Stress Analysis", Dave and Adams,

OPERATION MANAGEMENT

Sub Code	: 10ME 81	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT 1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, 9th Ed., Tata McGraw Hill.
2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management**, Norman Gaither & Greg Frazier,
2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.
3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	: 10ME 82	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering**, Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design**, M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems**, Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control**, Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System**, Schaum"s series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	: 10ME 831	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton"s Law of viscosity, Hagen-Poiseuille Law, Flow between

parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hours**

UNIT - 2

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D. **06 Hours**

UNIT - 3

Idealized Journal Bearing: introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems. **07 Hours**

UNIT - 4

Slider / Pad Bearing With A Fixed And Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples. **07 Hours**

PART - B

UNIT - 5

Oil Flow And Thermal Equilibrium Of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. **06 Hours**

UNIT - 6

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing. **06 Hours**

UNIT - 7

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials. **07 Hours**

UNIT - 8

Behavior Of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering **07 Hours**

TEXT BOOKS:

1. **Fundamentals of Tribology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006

2. **Introduction to Tribology Bearings**, Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENC BOOKS:

1. **Theory and Practice of Lubrication for Engineers**, Fuller, D., New York company 1998
2. **Principles and Applications of Tribology**, Moore, Pergamon press 1998
3. **Tribology in Industries**, Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design**, Redzimonvskay E I., Oxford press company 2000

POWER PLANT ENGINEERING

Sub Code	: 10ME 833	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1

Steam Power Plant:

Different types of fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverised fuel, Equipment for preparation and burning of pulverised coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace.

7 Hrs

UNIT 2

Coal, Ash Handling and Different Types of Boilers :

Coal and Ash handling, Generation of steam using forced circulation, high and supercritical pressures, A brief account of L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators.

6 Hrs

UNIT 3

Chimneys, Accessories for the Steam Generator Cooling Towers And Ponds:

Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft. Accessories For The Steam Generator such as super-heaters, desuperheater, control of super heaters, Economisers, Air Pre-heaters Study of different types of cooling towers and ponds.

6 Hrs

UNIT 4

Diesel Engine and Gas Turbine Power Plant:

Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, Intake and exhaust system, Layout of a diesel power plant. Advantages and disadvantages of the gas turbine plant, Open and closed cycle turbine plants with the accessories.

7Hrs

PART – B

UNIT 5

Hydro-Electric Plants: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, gates and valves, power house,

general layout. A brief description of some of the important Hydel Installations in India.

7Hrs

UNIT 6

Nuclear Power Plant: Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the Nuclear reactor, Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types - Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Radio active waste disposal.

7 Hrs

UNIT 7

Choice of site for power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, Effect of variable load on power plant, selection of the number and size of units.

6 Hrs

UNIT 8

Economic Analysis of power plant: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, tariffs for electrical energy.

6 Hrs

TEXT BOOKS:

1. **Power Plant Engineering**, P.K Nag, 3rd Ed. Tata McGraw Hill 2nd ed 2001,
2. **Power Plant Engineering**. Morse F.T., Van Nstrand.1998

REFERENCE BOOKS:

1. **Water Power Engg.**, Edition 3, Barrows, TMH, New Delhi. 1998
2. **Plant Engg. Hand Book**, Stanier, McGraw Hill. 1998
3. **Hydraulic Machines**, Jagadish Lal, Metropolitan Co 1996.
4. **Principles of Energy Conversion**, A.W. Culp Jr., McGraw Hill. 1996
5. **Power Plant Technology**, M.M. EL-Wakil, McGraw Hill, International. 1994
6. **Power Station Engg. Economics**, Skrotizke and V opat. 1994
7. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons.2003

ELECTIVE-II (GROUP - E)

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 844	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Engine Components And Cooling & Lubrication Systems: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

Fuels, Fuel Supply Systems For Si And Ci Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

Power Trains: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

Drive To Wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

Suspension, Springs And Brakes: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

Automotive Emission Control Systems: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics**, William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007
2. **Automotive Mechanics**, S. Srinivasan, 2nd Ed., Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc
2. **Fundamentals of Automobile Engineering**, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.
4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 845	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Database And Database Users: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

06 Hours

UNIT - 2

Database Systems Concepts And Architecture: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

06 Hours

UNIT - 3

Data Modeling: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

08 Hours

UNIT - 4

Record Storage And Primary File Organizations: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

06 Hours

PART - B

UNIT - 5

Relational Data Model And Relational Algebra: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.

07 Hours

UNIT - 6

Structural Query Language (Sql): Data definition etc., in SQL2. Basic and complex queries in SQL, Inset, Delete; Update statements, and views in SQKL, embedded SQL.

07 Hours

UNIT - 7

Database Design: Design guidelines for relational schemas, functional dependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

07 Hours

UNIT - 8

System Implementation: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems**, Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System**, Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design**, Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems**, Designing and Building business applications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM**, Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

III SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. / Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT31	Engg. Maths – III	Mathematics	04	--	03	25	100	125
2	10ME32A/10ME32B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME33	Basic Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME34	Mechanics of Materials	Mechanical	04	--	03	25	100	125
5	10ME35	Manufacturing Process I	Mechanical	04	--	03	25	100	125
6	10ME36A/10ME36B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL37A/10MEL37B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL38A/10MEL38B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
III SEMESTER B.E. MECHANICAL				21/24	9	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

IV SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT41	Engg. Maths – IV	Mathematics	04	--	03	25	100	125
2	10ME42A/10ME42B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME43	Applied Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME44	Kinematics of Machines	Mechanical	04	--	03	25	100	125
5	10ME45	Manufacturing Process II	Mechanical	04	--	03	25	100	125
6	10ME46A/10ME46B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL47A/10MEL47B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL48A/10MEL48B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
				21	09	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME51	Management and Entrepreneurship	04	--	03	25	100	125
2	10ME52	Design of Machine Elements I	04	--	03	25	100	125
3	10ME53	Energy Engineering	04	--	03	25	100	125
4	10ME54	Dynamics of Machines	04	--	03	25	100	125
5	10ME55	Manufacturing Process III	04	--	03	25	100	125
6	10ME56	Turbo Machines	04	--	03	25	100	125
7	10MEL57	Fluid Mechanics & Machines Lab	--	03	03	25	50	75
8	10MEL58	Energy Conversion Engg. Lab		03	03	25	50	75
			24	06	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME61	Computer Integrated Manufacturing	04	--	03	25	100	125
2	10ME62	Design of Machine Elements II	04	--	03	25	100	125
3	10ME63	Heat & Mass Transfer	04	--	03	25	100	125
4	10ME64	Finite Element Methods	04	--	03	25	100	125
5	10ME65	Mechatronics & □ P	04	--	03	25	100	125
6	10ME66X	Elective 'A'	04	--	03	25	100	125
7	10MEL67	Heat & Mass Transfer Lab	--	03	03	25	50	75
8	10MEL68	CAMA Lab	--	03	03	25	50	75
			24	06	24	200	700	900

Elective 'A'	
10ME663 Refrigeration & Air Conditioning	
10ME665 Non Traditional Machining	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME71	Engineering Economics	04	--	03	25	100	125
2	10ME72	Mechanical Vibrations	04	--	03	25	100	125
3	10ME73	Hydraulics and Pneumatics	04	--	03	25	100	125
4	10ME74	Operations Research	04	--	03	25	100	125
5	10ME75X	Elective B	04	--	03	25	100	125
6	10ME76X	Elective C	04	--	03	25	100	125
7	10MEL77	Design Lab	--	03	03	25	50	75
8	10MEL78	CIM and Automation Lab	--	03	03	25	50	75
9	10MEL79	Project Phase I	--	--	--	50	--	50
			24	06	24	250	700	950

Elective 'B'	Elective 'C'
10ME754 Non Conventional Energy Sources	10ME761 Experimental Stress Analysis
10ME758 Total Quality Management	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME81	Operations Management	04	--	03	25	100	125
2	10ME82	Control Engineering	04	--	03	25	100	125
3	10ME83X	Elective D	04	--	03	25	100	125
4	10ME84X	Elective E	04	--	03	25	100	125
5	10ME85L	Project Work	--	06	03	100	100	200
6	10ME86L	Seminar	--	03	--	50	--	50
				09	15	250	500	750

Elective 'D'	Elective 'E'
10ME831 Tribology	10ME844Automotive Engineering
10ME833 Power Plant Engineering	
10ME838 Foundry Technology	

III Semester
MATERIAL SCIENCE AND METALLURGY

Sub Code	: 10ME 32A /42A	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT - 2

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT - 3

Fracture: Type I, Type II and Type III.

Creep: Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

07 Hours

UNIT - 4

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT - 5

Phase Diagram II: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT - 6

Heat treating of metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT - 7

Ferrous and non ferrous materials: Properties, Composition and uses of

- Grey cast iron, malleable iron, SG iron and steel
- Copper alloys-brasses and bronzes.
Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT - 8

Composite Materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering**, Smith, 4th Edition McGraw Hill, 2009
2. **Materials Science, Shackelford., & M. K. Muralidhara**, Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An Introduction to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering**, V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering**, H. VanVlack, Addison-Wesley Edn., 1998
6. **Materials Science and Engineering**,William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition,2001.
7. **The Science and Engineering of Materials**, Donald R. Asklund and Pradeep.P. Phule, Cengage Learning, 4th Ed.,2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	: 10ME 32B / 42B	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT-1:

Standards of measurement: Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2:

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3:

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4:

Interferometer and screw thread, gear measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 - wire and 3 - wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5:

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

UNIT-6:

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

UNIT-7:

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

UNIT-8:

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements**, R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation**, Alstuko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5th Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A.

BASIC THERMODYNAMICS

(Common to ME/IP/AU/IM/MA)

Sub Code	: 10ME33	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT- 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT- 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT- 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B

UNIT- 5

Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT- 6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT- 7

Thermodynamic relations: Maxwell relation, Clausius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT- 8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart

06 Hours

Data Handbooks :

1. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:

1. **Basic Engineering Thermodynamics**, A.Venkatesh, University Press, 2008
2. **Basic and Applied Thermodynamics**, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamics**, An Engineering Approach, Yunus A.Cengel and Michael A.Boles, Tata McGraw Hill publications, 2002
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Classical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamics**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics**, PHI, New Delhi, 2010

MECHANICS OF MATERIALS

Sub Code	: 10ME34	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks:	100

PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3:

Compound Stresses: Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods: Work and strain energy, Strain energy in bar/beams, Castigliano's theorem, Energy methods.

Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lamé's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5:

Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6:

Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / notched beams not included).

07 Hours

UNIT 7:

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:

Torsion of Circular Shafts and Elastic Stability of Columns :

Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. "**Mechanics of Materials**", by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2005
2. "**Mechanics of materials**", James.M.Gere, Thomson, Fifth edition 2004.
3. "**Mechanics of materials**", in SI Units, Ferdinand Beer & Russell Johnston, 5th Ed., TATA McGraw Hill- 2003.

REFERENCE BOOKS:

1. "**Strength of Materials**", S.S. Rattan, Tata McGraw Hill, 2009
2. "**Strength of Materials**", S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. "**Mechanics of Materials**", K.V. Rao, G.C. Raju, First Edition, 2007
4. "**Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. "**Strength of Materials**", W.A. Nash, 5th Ed., Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

(FUNDAMENTALS OF FOUNDRY & WELDING)

Sub Code	: 10ME35	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

CASTING PROCESS

UNIT 1

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.
Additives: Need, Types of additives used and their properties..

06 Hours

UNIT 2

Sand Moulding : Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO₂ mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

07 Hours

UNIT 4

Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding (**MAW**), Flux Shielded Metal Arc Welding (**FSMAW**), Inert Gas Welding (**TIG & MIG**) Submerged Arc Welding (**SAW**) and Atomic Hydrogen Welding processes. (**AHW**)

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07

Hours

UNIT 6

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7

Metallurgical aspect, in welding : Structure of welds, Formation of different zones during welding. Heat affected zone (**HAZ**). Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8

Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. “**Manufacturing Process-I**”, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. “**Manufacturing & Technology: Foundry Forming and Welding**”, P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. “**Process and Materials of Manufacturing**”, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. “**Manufacturing Technology**”, Serope Kalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code	: 10ME36A / 10ME46A	IA Marks	: 25
Hrs/week	: 04(1 Hrs. Theory & 2 Hrs Practical)	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

02 Hours

PART-A

UNIT 1:

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

08 Hours

UNIT 2:

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

08 Hours

PART-B

UNIT 3:

Keys & Joints :

Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

08 Hours

UNIT 4:

Couplings:

Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

08 Hours

PART - C

Assembly Drawings

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool Head of a shaper

18 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat & V.M.Panchal

REFERENCE BOOKS:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.
3. 'Machine Drawing with Auto CAD', Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
4. 'Auto CAD 2006, for engineers and designers', Sham Tickoo. Dream tech 2005
5. 'Machine Drawing', N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill,2006

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e. PART-A	1 x 20 = 20 Marks
PART-B	1 x 20 = 20 Marks
PART-C	1 x 60 = 60 Marks
<hr/>	
Total	= 100 Marks

FLUID MECHANICS

Sub Code	: 10ME 36B / 46B	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	100

PART – A

UNIT-1

Properties of Fluids: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2

Fluid Statics : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3

Buoyancy and Fluid Kinematics:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.

Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5

Fluid Flow Measurements : Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similitudes.

07 Hours

UNIT-6

Flow through pipes : Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

06 Hours

UNIT-7

Laminar flow and viscous effects : Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseuille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.

Introduction to compressible flow : Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. **Fluid Mechanics**, Ojush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. **Fluid Mechanics**, Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. **Fluid Mechanics and hydraulics**, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. **Fluid Mechanics (SI Units)**, Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics**, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
5. **Fluid Mechanics** - . Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	: 10MEL 37A / 47A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
 - (a). Ultrasonic flaw detection
 - (b). Magnetic crack detection
 - (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S, C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	: 10MEL 37B / 47B	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

FOUNDRY AND FORGING LABORATORY

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

- 1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
- 2 Permeability test
- 3 Core hardness & Mould hardness tests.
- 4 Sieve Analysis to find Grain Finest number of Base Sand
- 5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.

Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations :

- Calculation of length of the raw material required to do the model.

- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks
Calculation (Forging)	+ Forging Model	= 05 +25 = 30 Marks

Viva-Voce : 10 marks.

Total : 50 Marks.

MACHINE SHOP

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

ONE question from part -A: 30 Marks

ONE question from part -B: 10 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

APPLIED THERMODYNAMICS

Sub Code	: 10ME43	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

Unit 1:

Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

Unit 2:

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

Unit 3:

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

Unit 4:

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5:

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work,

optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6:

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8

Psychrometry: Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidities and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :

1. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychrometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkanna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,

2. **Fundamental of Classical Thermodynamics**, G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Sub Code	: 10ME44	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1:

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2:

Mechanisms: Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3:

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5:

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods):

Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6:

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines"**, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II

(Metal Removing Process)

Sub Code	: 10ME45	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT - 1

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07

Hours

UNIT - 2

Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3

Turning (Lathe), Shaping and Planing Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations

07 Hours

UNIT - 4

Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials. Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology**, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology**, R.K.Jain, Khanna Publications, 2003.
3. **Production Technology**, HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools**, G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	: 10AL 51	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co - Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINE ELEMENTS-I

Sub Code	: 10ME 52	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT- 1

Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

05 Hours

UNIT- 2

Design For Static & Impact Strength:

Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

07 Hours

UNIT - 3

Design For Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

08 Hours

UNIT - 4

Threaded Fasteners: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

06 Hours

PART - B

UNIT - 5

Design Of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

07 Hours

UNIT - 6

Cotter And Knuckle Joints, Keys And Couplings: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and

flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

07 Hours

UNIT - 7

Riveted and Welded Joints – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

07 Hours

UNIT - 8

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

05 Hours

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2009.
2. **Design of Machine Elements**, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

DESIGN DATA HANDBOOK

1. **Design Data Hand Book**, K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design**, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

ENERGY ENGINEERING

Sub Code	: 10ME 53	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures.

07 Hours

UNIT - 2

A Brief Account Of Benson, Velox Schmidt Steam Generators. Chimneys: Natural, forced, induced and balanced draft, Calculations and numericals involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air pre-heaters and re-heaters.

07 Hours

UNIT - 3

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

06 Hours

UNIT - 4

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numericals. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

06 Hours

PART - B

UNIT - 5

Nuclear Power Plant: Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste disposal.

06 Hours

UNIT - 6

Solar Energy: Solar Extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples).

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

08 Hours**UNIT - 7**

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC.

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy.

06 Hours**UNIT - 8**

Energy From Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation.

Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, classification of bio gas plants, factors affecting bio gas generation.

Thermo Chemical Route: Thermo chemical conversion on bio mass, types of gasifiers.

06 Hours**TEXT BOOKS:**

1. **Power Plant Engineering**, P. K. Nag Tata McGraw Hill 2nd edn 2001.
2. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons. 2003

REFERENCE BOOKS:

1. **Power Plant Engineering**, R. K. Rajput, Laxmi publication, New Delhi.
2. **Principles of Energy conversion**, A. W. Culp Jr., McGraw Hill. 1996

3. **Non conventional Energy sources**, G D Rai Khanna Publishers.
4. **Non conventional resources**, B H Khan TMH - 2007

DYNAMICS OF MACHINES

Sub Code	: 10ME 54	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1: Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

06 Hours

UNIT 2: Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

08 Hours

UNIT 3: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. ratio of belt tensions, centrifugal tension, power transmitted.

06 Hours

UNIT 4: Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

06 Hours

PART - B

UNIT 5: Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

08 Hours

UNIT 6: Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force. stability, sensitiveness. Isochronism, effort and power,

06 Hours

UNIT 7: Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

06 Hours

UNIT 8: Analysis of Cams: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers. Undercutting in Cams

06 Hours

TEXT BOOKS:

1. **Theory of Machines**, Sadhu Singh, Pearson Education. 2nd edition. 2007.
2. **Theory of Machines**, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.

REFERENCE BOOKS:

1. **“Theory of Machines & Mechanisms”**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009
2. **Mechanism and Machine Theory**, A.G.Ambekar PHI, 2007

MANUFACTURING PROCESS – III

(METAL FORMING PROCESS)

Sub Code	: 10ME 55	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction And Concepts: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain.

07 Hours

UNIT - 2

Effects Of Parameters: Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

06 Hours

UNIT - 3

Forging: Classification of forging processes. Forging machines & equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Simple problems.

07 Hours**UNIT - 4**

Rolling: Classification of Rolling processes. Types of rolling mills, expression for Rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, Effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables, simple problems.

06 Hours**PART - B****UNIT - 5**

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing, simple problems.

07 Hours**UNIT - 6**

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, simple problem

06 Hours**UNIT - 7**

Sheet & Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring, Simple problems

06 Hours**UNIT - 8**

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

07 Hours**TEXT BOOKS:**

1. **Mechanical metallurgy (SI units)**, G.E. Dieter, Mc Graw Hill pub.2001
2. **Manufacturing Process – III**, Dr. K.Radhakrishna, Sapna Book House, 2009.

REFERENCE BOOKS:

1. **Materials and Processes in Manufacturing**, E.paul, Degramo, J.T. Black, Ronald, A.K. Prentice -hall of India 2002
2. **Principles of Industrial metal working process**, G.W. Rowe, CBSpub. 2002
3. **Manufacturing Science**, Amitabha Ghosh & A.K. Malik - East - Westpress 2001
4. **Technology of Metal Forming Process**, Surendra kumar, PHI – 2008

TURBO MACHINES

Sub Code	: 10ME 56	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies. Application of first and second law's of thermodynamics to turbomachines, Efficiencies of turbomachines. Problems.

07 Hours

UNIT – 2

Thermodynamics of fluid flow: Static and Stagnation states- Incompressible fluids and perfect gases, Overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

07 Hours

UNIT – 3

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction,

utilization factor, Relation between degree of reaction and Utilization factor, Problems.

06 Hours

UNIT – 4

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

06 Hours

PART - B

UNIT – 5

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging, Problems.

07 Hours

UNIT – 6

Hydraulic Turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

07 Hours

UNIT – 7

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

06 Hours

UNIT – 8

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

06 Hours

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

TEXT BOOKS:

1. **An Introduction to Energy Conversion**, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. **Turbines, Compressors & Fans**, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. **Principals of Turbomachines**, D. G. Shepherd, The Macmillan Company (1964).
2. **Fluid Mechanics & Thermodynamics of Turbomachines**, S. L. Dixon, Elsevier (2005).
3. **Turbomachine**, B.K.Venkanna PHI, New Delhi 2009.
4. **Text Book of Turbomachines**, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

FLUID MECHANICS AND MACHINES LABORATORY

Sub Code	: 10MEL 57	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of coefficient of friction of flow in a pipe.
2. Determination of minor losses in flow through pipes.
3. Determination of force developed by impact of jets on vanes.
4. Calibration of flow measuring devices
 - a. Orifice Plate meter
 - b. Nozzle
 - c. Venturimeter
 - d. V-notch

18 Hours

PART - B

5. Performance testing of Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
6. Performance testing of Pumps
 - a. Single stage / Multi stage centrifugal pumps
 - b. Reciprocating pump
7. Performance test of a two stage Reciprocating Air Compressor
8. Performance test on an Air Blower

24 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup + 10)
One Question from Part B	-	25 Marks (05 Writeup + 20)
Viva-Voce	-	10 Marks

Total		50 Marks

ENERGY CONVERSION ENGINEERING LABORATORY

Sub Code	: 10MEL 58	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.

4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).
5. Use of planimeter

21 Hours**PART - B**

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for
 - (a) Four stroke Diesel Engine
 - (b) Four stroke Petrol Engine
 - (c) Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - (d) Two stroke Petrol Engine
 - (e) Variable Compression Ratio I.C. Engine.

21 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup+10)
One Question from Part B	-	25 Marks (05 Writeup+20)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER INTEGRATED MANUFACTURING

Sub Code	: 10ME 61	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT - 1

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Transfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

6 Hours

UNIT - 4

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering L above methods and computerized line balancing.

6 Hours

PART-B

UNIT - 5

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly Machine analysis of single station assembly. **Automated Guided Vehicle System:** Introduction,

Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.

6 Hours

UNIT - 7

Cnc Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

6 Hours

UNIT - 8

Robotics: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

2. **Automation, Production system & Computer Integrated manufacturing**, M. P. Groover Person India, 2007 2nd edition.
3. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing**, J. A. Rehg & Henry. W. Kraebber.
2. **CAD/CAM** by Zeid, Tata McGraw Hill.

DESIGN OF MACHINE ELEMENTS – II

Sub Code	: 10ME 62	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Cylinders & Cylinder Heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

08 Hours

UNIT - 2

Belts Ropes and Chains: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

05 Hours**UNIT - 3**

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

08 Hours**UNIT - 4**

Spur & Helical Gears: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

07 Hours**PART - B****UNIT - 5**

Bevel and Worm Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

07 Hours**UNIT - 6**

Clutches & Brakes: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

05 Hours**UNIT - 7**

Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

07 Hours**UNIT - 8**

IC Engine Parts: Design of piston, connecting rod and crank shaft.

05 Hours**DESIGN DATA HANDBOOK**

1. **Design Data Hand Book** , K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication

3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements**, V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007

REFERNCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design**, A CAD Approach: Andrew D DIMAROGONAS, John Wiley Sons, Inc, 2001.

HEAT AND MASS TRANSFER

Sub Code	: 10ME 63	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundry conditions of 1st, 2nd and 3rd Kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.

07 Hours

UNIT - 2

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hours**UNIT - 3**

One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

06 Hours**UNIT - 4**

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

07 Hours**PART - B****UNIT - 5**

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

06 Hours**UNIT - 6**

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hours

UNIT - 7

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion (no numericals).

07 Hours**UNIT - 8**

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hours**TEXT BOOKS:**

1. **Heat & Mass transfer**, Tirumaleshwar, Pearson education 2006
2. **Heat transfer-A basic approach**, Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach**, Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer**, Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer**, Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer**, P.K. Nag, Tata McGraw Hill 2002.

FINITE ELEMENT METHODS

Sub Code	: 10ME 64	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT-1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

UNIT-2

Basic Procedure: Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

UNIT-3

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

UNIT-4

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique.

06 Hrs

PART-B

UNIT-5

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

UNIT-6

Trusses: Stiffness matrix of Truss element. Numerical problems.

06 Hrs

UNIT-7

Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.

06 Hrs

UNIT-8

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs**TEXT BOOKS:**

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

MECHATRONICS & MICROPROCESSOR

Sub Code	: 10ME 65	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

Introduction to Mechatronic Systems: Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours**UNIT - 2**

Review of Transducers and Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours

UNIT 3

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

06 Hours**UNIT - 4**

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation.

07 Hours**PART - B****UNIT - 5**

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

07 Hours**UNIT - 6**

Logic Function: Data word representation. Basic elements of control systems 808SA processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

07 Hours**UNIT - 7**

Organization & Programming of Microprocessors: Introduction to organization of INTEL 808S-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

06 Hours**UNIT - 8**

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

06 Hours

TEXT BOOKS:

1. **Mechatronics**, W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming And Applications With 8085/8085A**, R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics and Microprocessors**, K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran, Wiley, 1st Ed, 2009
2. **Mechatronics - Principles, Concepts and applications** – Nitaigour and Premchand Mahilik - Tata McGraw Hill- 2003.
3. **Mechatronics Principles & applications**, Godfrey C. Onwubolu, Elsevier..
4. **Introduction Mechatronics & Measurement systems**, David.G. Aliciatore & Michael. B. Bihistaned, Tata McGraw Hill, 2000.

HEAT & MASS TRANSFER LABORATORY

Sub Code	: 10MEL 67	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.

21 Hours**PART - B**

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour

4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air - Conditioner
6. Experiment on Transient Conduction Heat Transfer

21 Hours**Scheme for Examination:**

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

Sub Code	: 10MEL 68	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A**Study of a FEA package and modeling stress analysis of**

- a. Bars of constant cross section area, tapered cross section area and stepped bar
6 Hours
- b. Trusses – (Minimum 2 exercises)
3 Hours
- c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc (Minimum 6 exercises)
12 Hours

PART - B

- a) Stress analysis of a rectangular plate with a circular hole
3 Hours
- b) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 4 exercises)
9 Hours

- c) Dynamic Analysis
- 1) Fixed – fixed beam for natural frequency determination
 - 2) Bar subjected to forcing function
 - 3) Fixed – fixed beam subjected to forcing function

9 Hours

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomason, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

ELECTIVE-II (GROUP - A)

REFRIGERATION AND

AIR CONDITIONING

Sub Code	: 10ME 663	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Methods Of Refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration.

06 Hours

UNIT – 2

Gas Cycle Refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages & dis-advantages of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numericals.

06 Hours

UNIT – 3

Multi Pressure Vapour Compression Systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid

carbon dioxide, System practices for multistage system.

07 Hours

UNIT - 4

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures

07 Hours

PART - B

UNIT – 5

Equipments Used In Vapour Compression Refrigeration System: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

06 Hours

UNIT - 6

Vapour Absorption System: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

07 Hours

UNIT - 7

Design Conditions: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

Load Calculations And Applied Psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

07 Hours**UNIT - 8**

Transmission And Distribution Of Air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

Controls In Refrigeration And Air Conditioning Equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

06 Hours**TEXT BOOKS:**

1. **‘Refrigeration and Air-Conditioning’** C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
2. **‘Refrigeration and Air-Conditioning’** W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.
3. **ASHRAE**, Hand Book, 2009

REFERENCE BOOKS:

1. **‘Principles of Refrigeration’** Dossat, Pearson-2006.
2. **„Heating, Ventilation and Air Conditioning’**, McQuiston, Wiley Students edition, 5th edition 2000.
3. **„Air conditioning’** PITA, 4th edition, pearson-2005
4. **‘Refrigeration and Air-Conditioning’** Manohar prasad
5. **‘Refrigeration and Air-Conditioning’** S C Arora & S Domkundwar, Dhanpat Rai Publication

NON-TRADITIONAL MACHINING

Sub Code	: 10ME 665	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.

05 Hours

UNIT - 2

Ultrasonic Machining (Usm): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hours

UNIT - 3

Abrasive Jet Machining (Ajm): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

07 Hours

UNIT - 4

Electrochemical Machining (Ecm): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

06 Hours

PART - B**UNIT - 5**

Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

06 Hours**UNIT - 6**

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

08 Hours**UNIT - 7**

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hours**UNIT - 8**

Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

07 Hours**TEXT BOOKS:**

1. **Modern machining process**, Pandey and Shan, Tata McGraw Hill 2000
2. **New Technology**, Bhattacharya 2000

REFERENCE BOOKS:

1. **Production Technology**, HMT Tata McGraw Hill. 2001

2. **Modern Machining Process**, Aditya. 2002
3. **Non-Conventional Machining**, P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook: Machining Volume 16**, Joseph R. Davis (Editor), American Society of Metals (ASM)

ENGINEERING ECONOMY

Sub Code	: 10ME 71	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3

Equivalent Annual-Worth Comparisons: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4

Rate-Of-Return Calculations And Depreciation: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5

Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6

Introduction, Scope Of Finance, Finance Functions: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7

Financial Ratio Analysis: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

Financial And Profit Planning: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy**, Riggs J.L., 4TH ed. , McGraw Hill, 2002
2. **Engineering Economy**, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy**, Tarachand, 2000.
2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000
3. **Financial Mangement**, Prasanna Chandra, 7th Ed., TMH, 2004
4. **Finacial Management**, IM PANDEY, Vikas Pub. House, 2002

MECHANICAL VIBRATIONS

Sub Code	: 10ME 72	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations**, S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations**, V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications**, W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations**, G. K. Grover, Nem Chand and Bros, 6th edition, 1996.

HYDRAULICS AND PNEUMATICS

Sub Code	: 10ME 73	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double - Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.

Compressed Air: Production of compressed air- Compressors Preparation of compressed air-Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

06 Hours

TEXT BOOKS:

1. **“Fluid Power with Applications”**, Anthony Esposito, Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics'**, Andrew Parr, Jaico Publishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata McGraw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks'** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems'**, S. R. Majumdar, Tata McGraw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

OPERATION RESEARCH

Sub Code	: 10ME 74	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

Solution Of Linear Programming Problems: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

Integer Programming: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

Pert-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

Sequencing: Basic assumptions, sequencing „n“ jobs on single machine using priority rules, sequencing using Johnson“s rule-„n“ jobs on 2 machines, „n“ jobs on 3 machines, „n“ jobs on „m“ machines. Sequencing 2 jobs on „m“ machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research**, P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research**, Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research**, A P Verma, S K Kataria & Sons, 2008
2. **Operations Research**, Paneerselvan, PHI
3. **Operations Research**, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research**, Hillier and Liberman, 8th Ed., McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

DESIGN LABORATORY

Sub Code	: 10MEL 77	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
 - a) Circular disc subjected to diametral compression.
 - b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:

One question from Part A -	20 Marks (05 Write up +15)
One question from Part B -	20 Marks (05 Write up +15)
Viva - Voce -	10 Marks

Total: 50 Marks

CIM & AUTOMATION LAB

Sub Code	: 10MEL 78	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master- CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examination:

Two questions from Part A - 40 Marks (20 Write up +20)
Viva - Voce - 10 Marks

Total: 50 Marks

NON-CONVENTIONAL ENERGY RESOURCE

Sub Code	: 10ME 754	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Subject Code	:	10ME754	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Letter

TOTAL QUALITY MANAGEMENT

Sub Code	: 10ME 758	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction : customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5

Quality Management Tools : Why Why, forced field analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6

Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7

Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Bald ridge, and sis sigma, a view toward the future.

07

Hours

UNIT - 8

Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
2. **100 Methods for Total Quality Management:** Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1
3. **Organisational Excellence through TQM,** H. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)
EXPERIMENTAL STRESS ANALYSIS

Sub Code	: 10ME 761	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

06 Hours

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photo-elasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photo-elasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photo-elastic model materials, Materials for 2D photo-elasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photo-elasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings. **08 Hours**

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. "Experimental Stress Analysis", Dally and Riley, McGraw Hill.
2. "Experimental Stress Analysis". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata McGraw Hill.

REFERENCES BOOKS :

1. "Photoelasticity Vol I and Vol II, M.M.Frocht, John Wiley & sons.
2. "Strain Gauge Primer", Perry and Lissner,
3. "Photo Elastic Stress Analysis", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "Motion Measurement and Stress Analysis", Dave and Adams,

OPERATION MANAGEMENT

Sub Code	: 10ME 81	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT 1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, 9th Ed., Tata McGraw Hill.
2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management**, Norman Gaither & Greg Frazier,
2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.
3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	: 10ME 82	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems,** Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control,** Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System,** Schaum"s series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	: 10ME 831	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton"s Law of viscosity, Hagen-Poiseuille Law, Flow between

parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hours**

UNIT - 2

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D. **06 Hours**

UNIT - 3

Idealized Journal Bearing: introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems. **07 Hours**

UNIT - 4

Slider / Pad Bearing With A Fixed And Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples. **07 Hours**

PART - B

UNIT - 5

Oil Flow And Thermal Equilibrium Of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. **06 Hours**

UNIT - 6

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing. **06 Hours**

UNIT - 7

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials. **07 Hours**

UNIT - 8

Behavior Of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering **07 Hours**

TEXT BOOKS:

1. **Fundamentals of Tribology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006

2. **Introduction to Tribology Bearings**, Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENC BOOKS:

1. **Theory and Practice of Lubrication for Engineers**, Fuller, D., New York company 1998
2. **Principles and Applications of Tribology**, Moore, Pergamon press 1998
3. **Tribology in Industries**, Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design**, Redzimonvskay E I., Oxford press company 2000

POWER PLANT ENGINEERING

Sub Code	: 10ME 833	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1

Steam Power Plant:

Different types of fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverised fuel, Equipment for preparation and burning of pulverised coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace.

7 Hrs

UNIT 2

Coal, Ash Handling and Different Types of Boilers :

Coal and Ash handling, Generation of steam using forced circulation, high and supercritical pressures, A brief account of L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators.

6 Hrs

UNIT 3

Chimneys, Accessories for the Steam Generator Cooling Towers And Ponds:

Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft. Accessories For The Steam Generator such as super-heaters, desuperheater, control of super heaters, Economisers, Air Pre-heaters Study of different types of cooling towers and ponds.

6 Hrs

UNIT 4

Diesel Engine and Gas Turbine Power Plant:

Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, Intake and exhaust system, Layout of a diesel power plant. Advantages and disadvantages of the gas turbine plant, Open and closed cycle turbine plants with the accessories.

7Hrs

PART – B

UNIT 5

Hydro-Electric Plants: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, gates and valves, power house,

general layout. A brief description of some of the important Hydel Installations in India.

7Hrs

UNIT 6

Nuclear Power Plant: Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the Nuclear reactor, Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types - Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Radio active waste disposal.

7 Hrs

UNIT 7

Choice of site for power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, Effect of variable load on power plant, selection of the number and size of units.

6 Hrs

UNIT 8

Economic Analysis of power plant: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, tariffs for electrical energy.

6 Hrs

TEXT BOOKS:

1. **Power Plant Engineering**, P.K Nag, 3rd Ed. Tata McGraw Hill 2nd ed 2001,
2. **Power Plant Engineering**. Morse F.T., Van Nstrand.1998

REFERENCE BOOKS:

1. **Water Power Engg.**, Edition 3, Barrows, TMH, New Delhi. 1998
2. **Plant Engg. Hand Book**, Stanier, McGraw Hill. 1998
3. **Hydraulic Machines**, Jagadish Lal, Metropolitan Co 1996.
4. **Principles of Energy Conversion**, A.W. Culp Jr., McGraw Hill. 1996
5. **Power Plant Technology**, M.M. EL-Wakil, McGraw Hill, International. 1994
6. **Power Station Engg. Economics**, Skrotizke and V opat. 1994
7. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons.2003

ELECTIVE-II (GROUP - E)

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 844	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Engine Components And Cooling & Lubrication Systems: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

Fuels, Fuel Supply Systems For Si And Ci Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

Power Trains: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

Drive To Wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

Suspension, Springs And Brakes: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

Automotive Emission Control Systems: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics**, William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007
2. **Automotive Mechanics**, S. Srinivasan, 2nd Ed., Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc
2. **Fundamentals of Automobile Engineering**, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.
4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 845	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Database And Database Users: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

06 Hours

UNIT - 2

Database Systems Concepts And Architecture: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

06 Hours

UNIT - 3

Data Modeling: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

08 Hours

UNIT - 4

Record Storage And Primary File Organizations: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

06 Hours

PART - B

UNIT - 5

Relational Data Model And Relational Algebra: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.

07 Hours

UNIT - 6

Structural Query Language (Sql): Data definition etc., in SQL2. Basic and complex queries in SQL, Inset, Delete; Update statements, and views in SQKL, embedded SQL.

07 Hours

UNIT - 7

Database Design: Design guidelines for relational schemas, functional dependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

07 Hours

UNIT - 8

System Implementation: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems**, Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System**, Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design**, Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems**, Designing and Building business applications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM**, Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME51	Management and Engineering Economics	3	2	0	03	80	20	100	4
2	15ME52	Dynamics of Machinery	3	2	0	03	80	20	100	4
3	15ME53	Turbo Machines	3	2	0	03	80	20	100	4
4	15ME54	Design of Machine Elements - I	3	2	0	03	80	20	100	4
5	15ME55X	Professional Elective-I	3	0	0	03	80	20	100	3
6	15ME56X	Open Elective-I	3	0	0	03	80	20	100	3
7	15MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	80	20	100	2
8	15MEL58	Energy Lab	1	0	2	03	80	20	100	2
TOTAL			21	06	04		640	160	800	26

Professional Elective-I		Open Elective-I	
15ME551	Refrigeration and Air-conditioning	15ME562	Energy and Environment
15ME554	Non Traditional Machining		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

MANAGEMENT AND ENGINEERING ECONOMICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Management And Engineering Economics	15ME51	04	3-2-0	80	20	3Hrs

MODULE – 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought- early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans. **10 Hours**

MODULE - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief) **10 Hours**

MODULE -3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity.

Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems **10 Hours**

MODULE -4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems **10 Hours**

MODULE -5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems. **10 Hours**

Course outcomes

On completion of this subject students will be able to

1. Understand needs, functions, roles, scope and evolution of Management
2. Understand importance, purpose of Planning and hierarchy of planning and also analyze its types
3. Discuss Decision making, Organizing, Staffing, Directing and Controlling
4. Select the best economic model from various available alternatives
5. Understand various interest rate methods and implement the suitable one.
6. Estimate various depreciation values of commodities
7. Prepare the project reports effectively.

TEXT BOOKS

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Dynamics of Machinery	15ME52	04	3-2-0	80	20	3Hrs

Course Objectives

1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.
2. Analyse the mechanisms for static and dynamic equilibrium.
3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.
4. Analyse the balancing of rotating and reciprocating masses, governors and gyroscopes.
5. To understand vibrations characteristics of single degree of freedom systems.
6. Characterise the single degree freedom systems subjected to free and forced vibrations with and without damping.

MODULE 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

10 Hours

MODULE 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

10 Hours

MODULE 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

10 Hours

MODULE - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

10 Hours

MODULE – 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

10 Hours

Course outcomes

On completing the course the student will be able to

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

Text Books:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K.Grover, Nem Chand and Bros.

Reference Books:

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Turbo Machines	15ME53	04	3-2-0	80	20	3Hrs

Course Objectives:

- The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.
- Explain the working principles of turbomachines and apply it to various types of machines
- It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.

Module 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process **(10 Hours)**

Module 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

(10 Hours)

Module 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

(10 Hours)

Module 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and**

Propeller turbines - velocity triangles, design parameters. Problems. **(10 Hours)**

Module 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

(10 Hours)

Course Outcomes:

- Able to give precise definition of turbomachinery
- Identify various types of turbo machinery
- Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
- Understand the principle of operation of pumps, fans, compressors and turbines.
- Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)
- Analyze the performance of turbo machinery.

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).

3. Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements	15ME54	04	3-2-0	80	20	3Hrs

Course Objectives

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module-1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.

Static Stresses: Static loads .Normal, Bending, Shear and Combined stresses. Stress concentration and determination of stress concentration factor.

10 Hours

Module -2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.

Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

10Hours

Module -3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads.

Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

10 Hours

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

10 Hours

Module -5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

10 Hours

Course outcomes

On completion of the course the student will be able to

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

Text Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

Reference Books:

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
(Professional Elective-I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Refrigeration And Air-Conditioning	15ME551	03	3-0-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course objectives

1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems
2. Understand the working principles and applications of different types of refrigeration systems
3. Study the working of air conditioning systems and their applications
4. Identify the performance parameters and their relations of an air conditioning system

Module – I

Introduction to Refrigeration –Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications:Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing and food chain, Miscellaneous
8 Hours

Module – II

Vapour Compression Refrigeration System(VCRS): Comparison of Vapour Compression Cycle and Gas cycle,Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency,Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP – Ewing’s construction and Gosney’s method.Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure,Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

10 Hours

Module – III

Vapour Absorption Refrigeration Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.Practical problems – crystallization and air leakage, Commercial systems

Other types of Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermo acoustic refrigeration systems

8

Hours

Module – IV

Refrigerants:Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

8 Hours

Module – V

Air-Conditioning: Introduction to Air-Conditioning, Basic Definition, Classification, power rating, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapour compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

Data Book:

1. Shan K. Wang, Handbook of Air Conditioning and Refrigeration, 2/e, 2001 McGraw-Hill Education
2. Mathur M.L. & Mehta, Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, F.S., Jain Brothers, 2008

E- Learning

- VTU, E- learning, MOOCS, Open courseware

**NON TRADITIONAL MACHINING
(Professional Elective-I)**

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Non Traditional Machining	15ME554	03	3-0-0	80	20	3Hrs

MODULE 1

INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

08 hours

MODULE 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

08 hours

MODULE 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process.

Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

10 hours

MODULE 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

08 hours

MODULE 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

08 hours

Course Outcomes

On completion of the course, the students will be able to

1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.
2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

Text Books:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

Reference Books

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
(OPEN ELECTIVE – I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy And Environment	15ME562	03	3-0-0	80	20	3Hrs

Course Objectives

1. Understand energy scenario, energy sources and their utilization
2. Learn about methods of energy storage, energy management and economic analysis
3. Have proper awareness about environment and eco system.
4. Understand the environment pollution along with social issues and acts.

Module – I

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment. **8 Hours**

Module – II

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems

Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing

Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries

Economic Analysis: Scope, Characterization of an Investment Project

10 Hours

Module – III

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.

Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. **8 Hours**

Module – IV

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies. **8 Hours**

Module – V

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS:

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S rao, New Age Inytermnational, 2006, reprint 2015, 2nd edition
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

E- Learning

- India Energy Outlook 2015(www.iea.org/.../IndiaEnergyOutlook_WEO2015.pdf)
- Open courseware

FLUID MECHANICS & MACHINERY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Mechanics & Machinery Lab	15MEL57	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Turbo Machines

Prerequisites : Fluid Mechanics and Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART – B

7. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
8. Performance hydraulic Pumps
 - d. Single stage and Multi stage centrifugal pumps
 - e. Reciprocating pump
9. Performance test on a two stage Reciprocating Air Compressor
10. Performance test on an Air Blower

PART – C (Optional)

11. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
12. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course Outcomes:

At the end of this course students are able to,

1. Perform experiments to determine the coefficient of discharge of flow measuring devices.
2. Conduct experiments on hydraulic turbines and pumps to draw characteristics.
3. Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
4. Determine the energy flow pattern through the hydraulic turbines and pumps
5. Exhibit his competency towards preventive maintenance of hydraulic machines

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 25 Marks
ONE question from part -B: 40 Marks
Viva –Voice : 15 Marks
Total: 80 Marks

ENERGY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Lab	15MEL58	02	1-0-2	80	20	3Hrs

Prerequisites: Basic and Applied Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
3. Exhaust emissions of I C Engines will be measured and compared with the standards.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART - B

7. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
8. Measurements of Exhaust Emissions of Petrol engine.
9. Measurements of Exhaust Emissions of Diesel engine.
10. Measurement of $p\theta$, pV plots using Computerized IC engine test rig

PART – C (Optional)

11. Visit to Automobile Industry/service stations.
12. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course Outcomes: At the end of this course students are able to,

1. Perform experiments to determine the properties of fuels and oils.
2. Conduct experiments on engines and draw characteristics.
3. Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
4. Identify exhaust emission, factors affecting them and report the remedies.
5. Determine the energy flow pattern through the I C Engine
6. Exhibit his competency towards preventive maintenance of IC engines.

References

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) – USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai& sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME61	Finite Element Analysis	3	2	0	03	80	20	100	4
2	15ME62	Computer integrated Manufacturing	4	0	0	03	80	20	100	4
3	15ME63	Heat Transfer	3	2	0	03	80	20	100	4
4	15ME64	Design of Machine Elements -II	3	2	0	03	80	20	100	4
5	15ME65X	Professional Elective-II	3	0	0	03	80	20	100	3
6	15ME66X	Open Elective-II	3	0	0	03	80	20	100	3
7	15MEL67	Heat Transfer Lab	1	0	2	03	80	20	100	2
8	15MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	80	20	100	2
TOTAL			21	6	04		640	160	800	26

Professional Elective-II		Open Elective-II	
15ME653	Metal Forming	15ME664	Total Quality Management
15ME655	Automobile Engineering		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

FINITE ELEMENT ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Finite Element Analysis	15ME61	04	3-2-0	80	20	3Hrs

Course Objectives:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Module I

Introduction to Finite Element Method :General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems.Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

10 Hours

Module II

One-Dimensional Elements-Analysis of Bars and Trusses,

Linear interpolation polynomials in terms of localcoordinate's for1D, 2Delements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, , , Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA

8), 2D isoparametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Fore terms: Body force, traction force and point loads,

Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses.

10 Hours

Module III

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.

Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

08 Hours

Module IV

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic net works.

10 Hours

Module V

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.

Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind formulation methods in FEM.
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
3. Develop element characteristic equation and generation of global equation.
4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

12Hours

Text Books:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergaman Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

Reference Books:

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing	15ME62	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
CLO2	To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
CLO3	To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
CLO4	To expose students to computer aided process planning, material requirement planning, capacity planning etc.
CLO5	To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
CLO6	To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module - 1

1. Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems. **5 Hours**

2. Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems. **5 Hours**

Module – 2

3. CAD and Computer Graphics Software:The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

5 Hours

4. Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

5 Hours

Module- 3

5. Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

5 Hours

6. Line Balancing: Linebalancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line balancing, computerized line balancing methods.

5 Hours

Module-4.

7. Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

5 Hours

8. Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: material handling, processing and assembly and inspection.

5 Hours

Module – 5

9. Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing. **5 Hours**

10. Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems. **5 Hours**

Course Outcomes:

After studying this course, students will be able to:

CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen.
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
CO3	Analyze the automated flow lines to reduce down time and enhance productivity.
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Text Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

Reference Books:

1. “CAD/CAM” by Ibrahim Zeid, Tata McGraw Hill.
2. “Principles of Computer Integrated Manufacturing”, S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.

3. “Work Systems And The Methods, Measurement And Management of Work”, Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. “Computer Automation in Manufacturing”, Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. “Introduction to Robotics: Mechanics And Control”, Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. **“Understanding Additive Manufacturing”**, Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer	15ME63	04	3-2-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course learning objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module – I

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel. **8 Hours**

Module – II

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts. **9 Hours**

Module – III

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction, one dimensional unsteady conduction, two-dimensional steady and unsteady conduction, the difference equation, boundary conditions, solution methods, cylindrical coordinates and irregular boundaries.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield. **9 Hours**

Module – IV

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

8 Hours

Module – V

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers.

Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

9 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Understand the basic modes of heat transfer.
- Compute temperature distribution in steady-state and unsteady-state heat conduction
- Understand and interpret heat transfer through extended surfaces.
- Interpret and compute forced and free convective heat transfer.
- Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
- Design heat exchangers using LMTD and NTU methods.

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.

REFERENCE BOOKS:

1. Heat and mass transfer, Kurt C. Rolfe, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sagma, Bookboon.com

MOOCs:

1. Fluid flow, Heat and Mass Transfer- <http://ocw.tudelft.nl/courses/applied-earth-sciences/fluid-flow-heat-mass-transfer/course>
2. Heat transfer course- <https://legacy.saylor.org/me204/Intro/>

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN OF MACHINE ELEMENTS II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements II	15ME64	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To understand various elements involved in a mechanical system.
CLO2	To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
CLO3	To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
CLO4	To design completely a mechanical system integrating machine elements.
CLO5	To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

MODULE I

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

08 Hours

MODULE 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains. (Only theoretical treatment)

Springs:Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs;springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs,equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

10 Hours

MODULE 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

12 Hours

MODULE 4

Worm Gears:Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches:Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes:Types of Brakes, Block and Band brakes,selflocking of brakes, and heat generation in brakes.

10 Hours

MODULE 5

Lubrication and Bearings:Lubricants and their properties, bearing materials and properties;mechanisms of lubrication,hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.

Numerical examples on hydrodynamic journal and thrust bearing design.

Anti friction bearings:Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

10 Hours

Course Outcomes:

After learning the course the students should be able to:

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs,belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers, catalogue.
C07	Develop proficiency to generate production drawings using CAD software.
C08	Become good design engineers through learning the art of working in a team with morality and ethics.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, single plate clutch, etc.)A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings,completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit (5 marks) in internal assessment.

Textbooks:

- [1] Richard G. Budynas,and J. Keith Nisbett,“Shigley's Mechanical Engineering Design”, McGraw-Hill Education, 10th Edition, 2015.
- [2] Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, Wiley student edition, 2007.
- [3] V. B. Bhandari, “*Design of Machine Elements*”,4th Ed., Tata Mcgraw Hill, 2016.

References:

- [1] Robert L. Norton “Machine Design- an integrated approach”, Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E “Design and Machine Elements”, Pearson Education, 8th edition,2006.
- [3] Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.

[4] Hall, Holowenko, Laughlin (Schaum's Outline Series), "Machine design" adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.

[5] G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill, 2nd edition,2004.

Design Data Hand Book:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010

[4]PSG Design Data Hand Book, PSG College of technology, Coimbatore.

METAL FORMING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Metal Forming	15ME653	3	3-0-0	80	20	3Hrs

Course objectives:

The course is intended to provide basic understanding of Metal Forming with following aspects:

- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes
- Understanding plastic deformation during forming processes

MODULE -1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties. **10 Hrs**

MODULE -2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems. **10 Hrs**

MODULE -3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems. **10 Hrs**

MODULE -4

Extrusion:Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems. **10 Hrs**

MODULE -5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations. **10 Hrs**

Course outcomes:

On completion of this subject, students will be:

2. Able to understand the concept of different metal forming process.
3. Able to approach metal forming processes both analytically and numerically
4. Able to design metal forming processes
5. Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuwanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS:

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K , Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

AUTOMOBILE ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam duration
				SEE	CIA	
Automobile	15ME655	3	3-0-0	80	20	3 Hrs

Course learning objectives: The student will be able to learn

- The layout and arrangement of principal parts of an automobile
- The working of transmission and brake systems
- The operation and working of steering and suspension systems
- To know the Injection system and its advancements
- To know the automobile emissions and its effects on environment

MODULE 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system. **10 Hours**

MODULE 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical **08 Hours**

MODULE 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system. **08 Hours**

MODULE 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

08 Hours

MODULE 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

08 Hours

Course Outcomes: Student will be able

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, Satya Prakashan,(4th Edition) 1984.

TOTAL QUALITY MANAGEMENT

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Total Quality Management	15ME664	03	3-0-0	80	20	3Hrs

COURSE LEARNING OBJECTIVES:

This course enables students to

1. Understand various approaches to TQM
2. Understand the characteristics of quality leader and his role.
3. Develop feedback and suggestion systems for quality management.
4. Enhance the knowledge in Tools and Techniques of quality management

Module - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

08 Hours

Module - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

08 Hours

Module - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

08 Hours

Module - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

08 Hours

COURSE OUTCOMES:

Student will be able to

1. Explain the various approaches of TQM
2. Infer the customer perception of quality
3. Analyze customer needs and perceptions to design feedback systems.
4. Apply statistical tools for continuous improvement of systems
5. Apply the tools and technique for effective implementation of TQM.

TEXT BOOKS:

1. Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. Managing for Quality and Performance Excellence by James R.Evans and William M Lindsay, 9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Reference Books:

1. Engineering Optimization Methods and Applications, A Ravindran, K, M.Ragsdell, Wiley India Private Limited, 2nd Edition, 2006.
2. : Introduction to Operations Research- Concepts and Cases, F.S. Hillier. G.J. Lieberman, 9th Edition, Tata McGraw Hill. 2010.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Heat Transfer Lab

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer Lab	15MEL67	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Heat Transfer

Course Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Stefan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.
7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course Outcomes: At the end of this course students are able to,

- Perform experiments to determine the thermal conductivity of a metal rod

- Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
- Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
- Determine surface emissivity of a test plate
- Estimate performance of a refrigerator and effectiveness of fin
- Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

Modeling and Analysis Lab (FEA)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Modeling and Analysis Lab	15MEL68	02	1-0-2	80	20	3Hrs

CREDITS – 02

Prerequisites: Knowledge of any Modeling software, knowledge of coordinate systems and Geometric transformations etc.

Course objectives:

The course is intended to provide basic understanding of Modeling and Analysis techniques students with following aspects:

- To acquire basic understanding of Modeling and Analysis software
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

PART – A

Study of a FEA package and modeling and stress analysis of:

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load , UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART - B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination

- b) Bar subjected to forcing function
- c) Fixed – fixed beam subjected to forcing function

PART – C (only for demo and oral exam)

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course Outcomes: At the end of the course the students are able to:

- Demonstrate the basic features of an analysis package.
- Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.
- Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
- Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
- Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 32 Marks (08 Write up +24)

One Question from Part B - 32 Marks (08 Write up +24)

Viva-Voce - 16 Marks

Total 80 Marks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME71	Energy Engineering	3	2	0	03	80	20	100	4
2	15ME72	Fluid Power Systems	4	0	0	03	80	20	100	4
3	15ME73	Control Engineering	3	2	0	03	80	20	100	4
4	15ME74X	Professional Elective - III	3	0	0	03	80	20	100	3
5	15ME75X	Professional Elective-IV	3	0	0	03	80	20	100	3
6	15MEL76	Design Lab	1	0	2	03	80	20	100	2
7	15MEL77	CIM Lab	1	0	2	03	80	20	100	2
8	15MEP78	Project Phase – I	-	-	-	-	-	100	100	2
TOTAL			18	4	04		560	240	800	24

Professional Elective-III		Professional Elective-IV	
15ME742	Tribology	15ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

ENERGY ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Engineering	15ME71	04	3-2-0	80	20	3Hrs

Course learning objectives is to

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods and their analysis
- Study the principles of renewable energy conversion systems
- Understand the concept of green energy and zero energy.

Module – I

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

9 Hours

Module – II

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

7 Hours

Module – III

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

8 Hours

Module – IV

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

8 Hours

Module – V

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Summarize the basic concepts of thermal energy systems,
- Identify renewable energy sources and their utilization.
- Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
- Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
- Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
- Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS:

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

Scheme of Examination: Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

FLUID POWER SYSTEMS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Power Systems	15ME72	04	3-2-0	80	20	3Hrs

Course objectives:

CLO1	To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
CLO2	To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
CLO3	To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
CLO4	Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
CLO5	To familiarize with logic controls and trouble shooting

Module 1: Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

10 hours

Module 2: Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

10 hours

Module 3: Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design:Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application,hydrauliccylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for force multiplication;speedcontrol of hydraulic cylinder- metering in, metering out and bleed off circuits.Pilot pressure operated circuits.Hydraulic circuit examples withaccumulator.

10 hours

Module4: Pneumatic power systems

Introduction to Pneumatic systems:Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

10 hours

Module5: Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

10 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Identify and analyse the functional requirements of a fluid power transmission system for a
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	given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000 .
2. Majumdar S.R., "Oil Hydraulics", TalaMcGrawHill, 2002 .
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS:

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol I, II and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

- a. Speed control circuit using metering in and metering out technique
- b. Regenerative and sequencing circuits.
- c. Extend-Retract and Stop system of a linear actuator
- d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

- a. Automatic reciprocating circuit
- b. Speed control circuit
- c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
- d. Electro pneumatic valves and circuit

Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment (5 Marks).

List of Open Source Software/learning website:

1. Simulink
2. SimHydraulics

CONTROL ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Control Engineering	15ME73	04	3-2-0	80	20	3Hrs

Course Objectives	<ol style="list-style-type: none"> 1. Modeling of mechanical, hydraulic, pneumatic and electrical systems. 2. Representation of system elements by blocks and its reduction 3. Transient and steady state response analysis of a system. 4. Frequency response analysis using polar plot. 5. Frequency response analysis using bode plot. 6. Analysis of system using root locus plots. 7. Different system compensators and variable characteristics of linear systems.
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MODULE I

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

(7 Hours)

MODULE 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.
(3 hours)

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

(4 hours)

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

(6 Hours)

MODULE 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.
(3 hours)

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.
(4 hours)

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation
(6 Hours)

MODULE 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins
(14 Hours)

MODULE 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test .
(7 Hours)

Course Outcomes
CO1: Recognize control system and its types , control actions
CO2: Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3: Calculate the gain of the system using block diagram and signal flow graph
CO4: Illustrate the response of 1st and 2nd order systems
CO5: Determine the stability of transfer functions in complex domain and frequency domain
CO6: Employ state equations to study the controllability and observability

TRIBOLOGY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Tribology	15ME742	03	3-0-0	80	20	3Hrs

Course objectives:

CLO1	To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.
CLO2	To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
CLO3	To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
CLO4	To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
CLO5	To introduce the concepts of surface engineering and its importance in tribology.

Module 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

8 hours

Module 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

8 hours

Module 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

10 hours

Module 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

8 hours

Module5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapor phase processes.

Selection of coating for wear and corrosion resistance.

8 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Use of approved Design Data Handbook/charts can be permitted during the examination.

TEXTBOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCES:

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Mechatronics	15ME753	03	3-0-0	80	20	3 Hrs

Course objectives:

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Understand the applications of microprocessors in various systems and to know the functions of each element
4. Demonstrate the integration philosophy in view of Mechatronics technology

MODULE -1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors. 10 Hours

MODULE -2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor. 10 Hours

MODULE -3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot. 10 Hours

MODULE -4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors. 10 Hours

MODULE -5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve,

solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

10 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Develop mechanical, hydraulic, pneumatic and electrical control systems.

TEXT BOOKS:

1. NitaigourPremchandMahalik , Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1stEdition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W.Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1stEdition, 2005 ISBN No. 81-7758-284-4.

REFERENCE BOOKS:

1. Mechatronics by HMT Ltd. – Tata McGrawHill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power , Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN LABORATORY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design Laboratory	15MEL76	02	1-0-2	80	20	3Hrs

Prerequisites: Knowledge of Dynamics and Machines and Design of Machine Elements

COURSE OBJECTIVES:

Students are expected-

1. To understand the natural frequency, logarithmic decrement, damping ratio and damping.
2. To understand the balancing of rotating masses.
3. To understand the concept of the critical speed of a rotating shaft.
4. To understand the concept of stress concentration using Photo elasticity.
5. To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART –A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART –B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.
5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

Scheme of Examination:

One question from Part A:	32 Marks
One question from part B:	32 Marks
Viva- Voce:	16 Marks
Total:	80 Marks

Reference Books:

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

COMPTER INTEGRATED MANUFACTURING LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing LAB	15MEL77	02	1-0-2	80	20	3Hrs

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes.
CLO2	To educate the students on the usage of CAM packages.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations.

3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master- CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Cut the part in single block and auto mode and measure the virtual part on screen.

Post processing of CNC programs for standard CNC control systems like FANUC, SINUMERIC and MISTUBISHI.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time.
CLO6	Understand & write programs for Robotcontrol; understand the operating principles of hydraulics, pneumatics and electropneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	15MEP78	2	0-3-0	100	-	-

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME81	Operations Research	3	2	0	03	80	20	100	4
2	15ME82	Additive Manufacturing	4	0	0	03	80	20	100	4
3	15ME83X	Professional Elective - V	3	0	0	03	80	20	100	3
4	15ME84	Internship / Professional Practice	Industry Oriented			03	50	50	100	2
5	15ME85	Project Phase – II	-	6	-	03	100	100	200	6
6	15MES86	Seminar	-	4	-	-	-	100	100	1
TOTAL			10	12	-		390	310	700	20

Professional Elective-V	
15ME832	Experimental Stress Analysis

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th& 7th semester vacation or 7th& 8th semester vacation.

OPERATIONS RESEARCH

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Operations Research	15ME81	4	3-2-0	80	20	3 Hrs

Course objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

MODULE -1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR,

Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

08 Hours

MODULE -2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

12 Hours

MODULE -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems.

Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

12 Hours

MODULE -4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models. 10 Hours

MODULE -5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method. 08 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD.

Publications, New Delhi – 2007

2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8thEd., McGraw Hill

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

ADDITIVE MANUFACTURING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Additive Manufacturing	15ME82	4	4-0-0	80	20	3 Hrs

Course Objectives:

Students will be able to

1. Understand the additive manufacturing process, polymerization and powder metallurgy process
2. Understand characterisation techniques in additive manufacturing.
3. Acquire knowledge on CNC and Automation.

Module 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries

10 Hours

Module 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, Triacs, Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

8 Hours

Module 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality,

12 Hours

	<p>Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting. Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.</p>	
Module 4		
	<p>NANO MATERIALS & CHARACTERIZATION TECHNIQUES: Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC). Optical Microscopy - principles, Imaging Modes, Applications, Limitations. Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. Transmission Electron Microscopy (TEM) - principles, Imaging Modes, Applications, Limitations.X- Ray Diffraction (XRD) - principles, Imaging Modes, Applications, Limitations.Scanning Probe Microscopy (SPM) - principles, Imaging Modes, Applications, Limitations, Limitations.Atomic Force Microscopy (AFM) - basic principles, instrumentation, operational modes, Applications, Limitations. Electron Probe Micro Analyzer (EPMA) - Introduction, Sample preparation, Working procedure, Applications, Limitations.</p>	10 Hours
Module 5		
	<p>MANUFACTURING CONTROL AND AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,</p>	10 Hours

	<p>Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)</p> <p>Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity</p> <p>Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.</p>	
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Course Outcomes

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programing and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Experimental Stress Analysis	15ME832	3	3-0-0	80	20	3 Hrs

Course Learning Objectives (CLO's):

1. To use the method of electrical strain gauges to study and characterize the elastic behavior of solid bodies.
2. To measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. To describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
4. To determine stress strain behavior of solid bodies using methods of coating.
5. To conduct stress strain analysis of solid bodies using the methods Holography

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. general consideration in data analysis.

03Hours

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gageconstruction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance' Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

05 Hours

Module -2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

04 Hours

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

02 Hours

Module –3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscope, Isoclinics&Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials

06Hours

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity

02 Hours

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

04 Hours

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings

06 Hours

Module –5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

05Hours

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

05Hours

Course Outcomes (CO's):

At the end of the course, the student will be able to:

1. Explain characterize the elastic behavior of solid bodies.
2. Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. Discuss skills for experimental investigations an accompanying laboratory course is desirable
4. Discuss experimental investigations by predictions by other methods.
5. Describe various coating techniques.

TEXT BOOKS:

1. "**Experimental Stress Analysis**", Dally and Riley, McGraw Hill.
2. "**Experimental Stress Analysis**". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.

REFERENCES BOOKS :

1. "**Photoelasticity Vol I and Vol II**", M.M.Frocht, John Wiley & sons.
2. "**Strain Gauge Primer**", Perry and Lissner,
3. "**Photo Elastic Stress Analysis**", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "**Motion Measurement and Stress Analysis**", Dave and Adams,
5. **Holman, Experimental Methods for Engineers**, Tata McGraw-Hill Companies, 7th Edition, New York, 2007.
6. **B. C. Nakra and K. K. Chaudhry**, Instrumentation, Measurement and Analysis, Tata McGraw-Hill Companies, Inc, New York, 7th Edition, 2006.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	15ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	15MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	15MES86	1	0-4-0	100	-	-

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

III SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. / Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT31	Engg. Maths – III	Mathematics	04	--	03	25	100	125
2	10ME32A/10ME32B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME33	Basic Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME34	Mechanics of Materials	Mechanical	04	--	03	25	100	125
5	10ME35	Manufacturing Process I	Mechanical	04	--	03	25	100	125
6	10ME36A/10ME36B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL37A/10MEL37B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL38A/10MEL38B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
III SEMESTER B.E. MECHANICAL				21/24	9	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

IV SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT41	Engg. Maths – IV	Mathematics	04	--	03	25	100	125
2	10ME42A/10ME42B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME43	Applied Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME44	Kinematics of Machines	Mechanical	04	--	03	25	100	125
5	10ME45	Manufacturing Process II	Mechanical	04	--	03	25	100	125
6	10ME46A/10ME46B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL47A/10MEL47B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL48A/10MEL48B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
				21	09	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME51	Management and Entrepreneurship	04	--	03	25	100	125
2	10ME52	Design of Machine Elements I	04	--	03	25	100	125
3	10ME53	Energy Engineering	04	--	03	25	100	125
4	10ME54	Dynamics of Machines	04	--	03	25	100	125
5	10ME55	Manufacturing Process III	04	--	03	25	100	125
6	10ME56	Turbo Machines	04	--	03	25	100	125
7	10MEL57	Fluid Mechanics & Machines Lab	--	03	03	25	50	75
8	10MEL58	Energy Conversion Engg. Lab		03	03	25	50	75
			24	06	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME61	Computer Integrated Manufacturing	04	--	03	25	100	125
2	10ME62	Design of Machine Elements II	04	--	03	25	100	125
3	10ME63	Heat & Mass Transfer	04	--	03	25	100	125
4	10ME64	Finite Element Methods	04	--	03	25	100	125
5	10ME65	Mechatronics & □ P	04	--	03	25	100	125
6	10ME66X	Elective 'A'	04	--	03	25	100	125
7	10MEL67	Heat & Mass Transfer Lab	--	03	03	25	50	75
8	10MEL68	CAMA Lab	--	03	03	25	50	75
			24	06	24	200	700	900

Elective 'A'	
10ME663 Refrigeration & Air Conditioning	
10ME665 Non Traditional Machining	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME71	Engineering Economics	04	--	03	25	100	125
2	10ME72	Mechanical Vibrations	04	--	03	25	100	125
3	10ME73	Hydraulics and Pneumatics	04	--	03	25	100	125
4	10ME74	Operations Research	04	--	03	25	100	125
5	10ME75X	Elective B	04	--	03	25	100	125
6	10ME76X	Elective C	04	--	03	25	100	125
7	10MEL77	Design Lab	--	03	03	25	50	75
8	10MEL78	CIM and Automation Lab	--	03	03	25	50	75
9	10MEL79	Project Phase I	--	--	--	50	--	50
			24	06	24	250	700	950

Elective 'B'	Elective 'C'
10ME754 Non Conventional Energy Sources	10ME761 Experimental Stress Analysis
10ME758 Total Quality Management	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME81	Operations Management	04	--	03	25	100	125
2	10ME82	Control Engineering	04	--	03	25	100	125
3	10ME83X	Elective D	04	--	03	25	100	125
4	10ME84X	Elective E	04	--	03	25	100	125
5	10ME85L	Project Work	--	06	03	100	100	200
6	10ME86L	Seminar	--	03	--	50	--	50
				09	15	250	500	750

Elective 'D'	Elective 'E'
10ME831 Tribology	10ME844Automotive Engineering
10ME833 Power Plant Engineering	
10ME838 Foundry Technology	

III Semester
MATERIAL SCIENCE AND METALLURGY

Sub Code	: 10ME 32A /42A	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT - 2

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT - 3

Fracture: Type I, Type II and Type III.

Creep: Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

07 Hours

UNIT - 4

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT - 5

Phase Diagram II: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT - 6

Heat treating of metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT - 7

Ferrous and non ferrous materials: Properties, Composition and uses of

- Grey cast iron, malleable iron, SG iron and steel
- Copper alloys-brasses and bronzes.
Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT - 8

Composite Materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering**, Smith, 4th Edition McGraw Hill, 2009
2. **Materials Science, Shackelford., & M. K. Muralidhara**, Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An Introduction to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering**, V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering**, H. VanVlack, Addison-Wesley Edn., 1998
6. **Materials Science and Engineering**, William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. **The Science and Engineering of Materials**, Donald R. Asklund and Pradeep.P. Phule, Cengage Learning, 4th Ed., 2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	: 10ME 32B / 42B	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT-1:

Standards of measurement: Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2:

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3:

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4:

Interferometer and screw thread, gear measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 - wire and 3 - wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5:

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

UNIT-6:

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

UNIT-7:

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

UNIT-8:

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements**, R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation**, Alstuko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5th Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A.

BASIC THERMODYNAMICS

(Common to ME/IP/AU/IM/MA)

Sub Code	: 10ME33	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT- 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT- 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT- 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B

UNIT- 5

Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT- 6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT- 7

Thermodynamic relations: Maxwell relation, Clausius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT- 8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart

06 Hours

Data Handbooks :

1. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:

1. **Basic Engineering Thermodynamics**, A.Venkatesh, University Press, 2008
2. **Basic and Applied Thermodynamics**, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamics**, An Engineering Approach, Yunus A.Cengel and Michael A.Boles, Tata McGraw Hill publications, 2002
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Classical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamics**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics**, PHI, New Delhi, 2010

MECHANICS OF MATERIALS

Sub Code	: 10ME34	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks:	100

PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3:

Compound Stresses: Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods: Work and strain energy, Strain energy in bar/beams, Castigliano's theorem, Energy methods.

Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lamé's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5:

Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6:

Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / notched beams not included).

07 Hours

UNIT 7:

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:

Torsion of Circular Shafts and Elastic Stability of Columns :

Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. "**Mechanics of Materials**", by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2005
2. "**Mechanics of materials**", James.M.Gere, Thomson, Fifth edition 2004.
3. "**Mechanics of materials**", in SI Units, Ferdinand Beer & Russell Johnston, 5th Ed., TATA McGraw Hill- 2003.

REFERENCE BOOKS:

1. "**Strength of Materials**", S.S. Rattan, Tata McGraw Hill, 2009
2. "**Strength of Materials**", S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. "**Mechanics of Materials**", K.V. Rao, G.C. Raju, First Edition, 2007
4. "**Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. "**Strength of Materials**", W.A. Nash, 5th Ed., Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

(FUNDAMENTALS OF FOUNDRY & WELDING)

Sub Code	: 10ME35	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

CASTING PROCESS

UNIT 1

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.
Additives: Need, Types of additives used and their properties..

06 Hours

UNIT 2

Sand Moulding : Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO₂ mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

07 Hours

UNIT 4

Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding (**MAW**), Flux Shielded Metal Arc Welding (**FSMAW**), Inert Gas Welding (**TIG & MIG**) Submerged Arc Welding (**SAW**) and Atomic Hydrogen Welding processes. (**AHW**)

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07

Hours

UNIT 6

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7

Metallurgical aspect, in welding : Structure of welds, Formation of different zones during welding. Heat affected zone (**HAZ**). Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8

Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. “**Manufacturing Process-I**”, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. “**Manufacturing & Technology: Foundry Forming and Welding**”, P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. “**Process and Materials of Manufacturing**”, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. “**Manufacturing Technology**”, Serope Kalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code	: 10ME36A / 10ME46A	IA Marks	: 25
Hrs/week	: 04(1 Hrs. Theory & 2 Hrs Practical)	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

02 Hours

PART-A

UNIT 1:

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

08 Hours

UNIT 2:

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

08 Hours

PART-B

UNIT 3:

Keys & Joints :

Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

08 Hours

UNIT 4:

Couplings:

Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

08 Hours

PART - C

Assembly Drawings

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool Head of a shaper

18 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat & V.M.Panchal

REFERENCE BOOKS:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.
3. 'Machine Drawing with Auto CAD', Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
4. 'Auto CAD 2006, for engineers and designers', Sham Tickoo. Dream tech 2005
5. 'Machine Drawing', N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill,2006

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e. PART-A	1 x 20 = 20 Marks
PART-B	1 x 20 = 20 Marks
PART-C	1 x 60 = 60 Marks
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Total	= 100 Marks

FLUID MECHANICS

Sub Code	: 10ME 36B / 46B	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	100

PART – A

UNIT-1

Properties of Fluids: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2

Fluid Statics : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3

Buoyancy and Fluid Kinematics:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.

Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5

Fluid Flow Measurements : Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similitudes.

07 Hours

UNIT-6

Flow through pipes : Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

06 Hours

UNIT-7

Laminar flow and viscous effects : Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseuille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.

Introduction to compressible flow : Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. **Fluid Mechanics**, Ojush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. **Fluid Mechanics**, Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. **Fluid Mechanics and hydraulics**, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. **Fluid Mechanics (SI Units)**, Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics**, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
5. **Fluid Mechanics** - . Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	: 10MEL 37A / 47A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
 - (a). Ultrasonic flaw detection
 - (b). Magnetic crack detection
 - (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S, C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	: 10MEL 37B / 47B	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

FOUNDRY AND FORGING LABORATORY

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

- 1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
- 2 Permeability test
- 3 Core hardness & Mould hardness tests.
- 4 Sieve Analysis to find Grain Finest number of Base Sand
- 5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.

Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations :

- Calculation of length of the raw material required to do the model.

- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks
Calculation (Forging)	+ Forging Model	= 05 +25 = 30 Marks

Viva-Voce : 10 marks.

Total : 50 Marks.

MACHINE SHOP

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

ONE question from part -A: 30 Marks

ONE question from part -B: 10 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

APPLIED THERMODYNAMICS

Sub Code	: 10ME43	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

Unit 1:

Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

Unit 2:

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

Unit 3:

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

Unit 4:

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5:

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work,

optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6:

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8

Psychrometry: Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :

1. **Thermodynamic data hand book**, B.T.Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkahna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,

2. **Fundamental of Classical Thermodynamics**, G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Sub Code	: 10ME44	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1:

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2:

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3:

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5:

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods):

Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6:

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines"**, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II

(Metal Removing Process)

Sub Code	: 10ME45	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT - 1

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07

Hours

UNIT - 2

Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3

Turning (Lathe), Shaping and Planing Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations

07 Hours

UNIT - 4

Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials. Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology**, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology**, R.K.Jain, Khanna Publications, 2003.
3. **Production Technology**, HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools**, G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	: 10AL 51	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co - Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINE ELEMENTS-I

Sub Code	: 10ME 52	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT- 1

Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

05 Hours

UNIT- 2

Design For Static & Impact Strength:

Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

07 Hours

UNIT - 3

Design For Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

08 Hours

UNIT - 4

Threaded Fasteners: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

06 Hours

PART - B

UNIT - 5

Design Of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

07 Hours

UNIT - 6

Cotter And Knuckle Joints, Keys And Couplings: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and

flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

07 Hours

UNIT - 7

Riveted and Welded Joints – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

07 Hours

UNIT - 8

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

05 Hours

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2009.
2. **Design of Machine Elements**, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

DESIGN DATA HANDBOOK

1. **Design Data Hand Book**, K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design**, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

ENERGY ENGINEERING

Sub Code	: 10ME 53	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures.

07 Hours

UNIT - 2

A Brief Account Of Benson, Velox Schmidt Steam Generators. Chimneys: Natural, forced, induced and balanced draft, Calculations and numericals involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air pre-heaters and re-heaters.

07 Hours

UNIT - 3

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

06 Hours

UNIT - 4

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numericals. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

06 Hours

PART - B

UNIT - 5

Nuclear Power Plant: Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste disposal.

06 Hours

UNIT - 6

Solar Energy: Solar Extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples).

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

08 Hours**UNIT - 7**

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC.

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy.

06 Hours**UNIT - 8**

Energy From Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation.

Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, classification of bio gas plants, factors affecting bio gas generation.

Thermo Chemical Route: Thermo chemical conversion on bio mass, types of gasifiers.

06 Hours**TEXT BOOKS:**

1. **Power Plant Engineering**, P. K. Nag Tata McGraw Hill 2nd edn 2001.
2. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons. 2003

REFERENCE BOOKS:

1. **Power Plant Engineering**, R. K. Rajput, Laxmi publication, New Delhi.
2. **Principles of Energy conversion**, A. W. Culp Jr., McGraw Hill. 1996

3. **Non conventional Energy sources**, G D Rai Khanna Publishers.
4. **Non conventional resources**, B H Khan TMH - 2007

DYNAMICS OF MACHINES

Sub Code	: 10ME 54	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1: Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

06 Hours

UNIT 2: Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

08 Hours

UNIT 3: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. ratio of belt tensions, centrifugal tension, power transmitted.

06 Hours

UNIT 4: Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

06 Hours

PART - B

UNIT 5: Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

08 Hours

UNIT 6: Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force. stability, sensitiveness. Isochronism, effort and power,

06 Hours

UNIT 7: Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

06 Hours

UNIT 8: Analysis of Cams: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers. Undercutting in Cams

06 Hours

TEXT BOOKS:

1. **Theory of Machines**, Sadhu Singh, Pearson Education. 2nd edition. 2007.
2. **Theory of Machines**, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009
2. **Mechanism and Machine Theory**, A.G.Ambekar PHI, 2007

MANUFACTURING PROCESS – III

(METAL FORMING PROCESS)

Sub Code	: 10ME 55	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction And Concepts: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain.

07 Hours

UNIT - 2

Effects Of Parameters: Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

06 Hours

UNIT - 3

Forging: Classification of forging processes. Forging machines & equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Simple problems.

07 Hours**UNIT - 4**

Rolling: Classification of Rolling processes. Types of rolling mills, expression for Rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, Effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables, simple problems.

06 Hours**PART - B****UNIT - 5**

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing, simple problems.

07 Hours**UNIT - 6**

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, simple problem

06 Hours**UNIT - 7**

Sheet & Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring, Simple problems

06 Hours**UNIT - 8**

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

07 Hours**TEXT BOOKS:**

1. **Mechanical metallurgy (SI units)**, G.E. Dieter, Mc Graw Hill pub.2001
2. **Manufacturing Process – III**, Dr. K.Radhakrishna, Sapna Book House, 2009.

REFERENCE BOOKS:

1. **Materials and Processes in Manufacturing**, E.paul, Degramo, J.T. Black, Ronald, A.K. Prentice -hall of India 2002
2. **Principles of Industrial metal working process**, G.W. Rowe, CBSpub. 2002
3. **Manufacturing Science**, Amitabha Ghosh & A.K. Malik - East - Westpress 2001
4. **Technology of Metal Forming Process**, Surendra kumar, PHI – 2008

TURBO MACHINES

Sub Code	: 10ME 56	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies. Application of first and second law's of thermodynamics to turbomachines, Efficiencies of turbomachines. Problems.

07 Hours

UNIT – 2

Thermodynamics of fluid flow: Static and Stagnation states-Incompressible fluids and perfect gases, Overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

07 Hours

UNIT – 3

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction,

utilization factor, Relation between degree of reaction and Utilization factor, Problems.

06 Hours

UNIT – 4

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

06 Hours

PART - B

UNIT – 5

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging, Problems.

07 Hours

UNIT – 6

Hydraulic Turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

07 Hours

UNIT – 7

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

06 Hours

UNIT – 8

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

06 Hours

(**Note:** Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

TEXT BOOKS:

1. **An Introduction to Energy Conversion**, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. **Turbines, Compressors & Fans**, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. **Principals of Turbomachines**, D. G. Shepherd, The Macmillan Company (1964).
2. **Fluid Mechanics & Thermodynamics of Turbomachines**, S. L. Dixon, Elsevier (2005).
3. **Turbomachine**, B.K.Venkanna PHI, New Delhi 2009.
4. **Text Book of Turbomachines**, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

FLUID MECHANICS AND MACHINES LABORATORY

Sub Code	: 10MEL 57	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of coefficient of friction of flow in a pipe.
2. Determination of minor losses in flow through pipes.
3. Determination of force developed by impact of jets on vanes.
4. Calibration of flow measuring devices
 - a. Orifice Plate meter
 - b. Nozzle
 - c. Venturimeter
 - d. V-notch

18 Hours

PART - B

5. Performance testing of Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines

6. Performance testing of Pumps
 - a. Single stage / Multi stage centrifugal pumps
 - b. Reciprocating pump

7. Performance test of a two stage Reciprocating Air Compressor

8. Performance test on an Air Blower

24 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup + 10)
One Question from Part B	-	25 Marks (05 Writeup + 20)
Viva-Voce	-	10 Marks

Total		50 Marks

ENERGY CONVERSION ENGINEERING LABORATORY

Sub Code	: 10MEL 58	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.

4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).
5. Use of planimeter

21 Hours**PART - B**

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for
 - (a) Four stroke Diesel Engine
 - (b) Four stroke Petrol Engine
 - (c) Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - (d) Two stroke Petrol Engine
 - (e) Variable Compression Ratio I.C. Engine.

21 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup+10)
One Question from Part B	-	25 Marks (05 Writeup+20)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER INTEGRATED MANUFACTURING

Sub Code	: 10ME 61	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT - 1

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Transfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

6 Hours

UNIT - 4

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering L above methods and computerized line balancing.

6 Hours

PART-B

UNIT - 5

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly Machine analysis of single station assembly. **Automated Guided Vehicle System:** Introduction,

Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.

6 Hours

UNIT - 7

Cnc Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

6 Hours

UNIT - 8

Robotics: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

2. **Automation, Production system & Computer Integrated manufacturing**, M. P. Groover Person India, 2007 2nd edition.
3. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing**, J. A. Rehg & Henry. W. Kraebber.
2. **CAD/CAM** by Zeid, Tata McGraw Hill.

DESIGN OF MACHINE ELEMENTS – II

Sub Code	: 10ME 62	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Cylinders & Cylinder Heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

08 Hours

UNIT - 2

Belts Ropes and Chains: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

05 Hours**UNIT - 3**

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

08 Hours**UNIT - 4**

Spur & Helical Gears: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

07 Hours**PART - B****UNIT - 5**

Bevel and Worm Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

07 Hours**UNIT - 6**

Clutches & Brakes: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

05 Hours**UNIT - 7**

Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

07 Hours**UNIT - 8**

IC Engine Parts: Design of piston, connecting rod and crank shaft.

05 Hours**DESIGN DATA HANDBOOK**

1. **Design Data Hand Book** , K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication

3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements**, V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007

REFERNCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design**, A CAD Approach: Andrew D DIMAROGONAS, John Wiley Sons, Inc, 2001.

HEAT AND MASS TRANSFER

Sub Code	: 10ME 63	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundry conditions of 1st, 2nd and 3rd Kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.

07 Hours

UNIT - 2

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hours**UNIT - 3**

One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

06 Hours**UNIT - 4**

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

07 Hours**PART - B****UNIT - 5**

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

06 Hours**UNIT - 6**

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hours

UNIT - 7

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion (no numericals).

07 Hours**UNIT - 8**

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hours**TEXT BOOKS:**

1. **Heat & Mass transfer**, Tirumaleshwar, Pearson education 2006
2. **Heat transfer-A basic approach**, Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach**, Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer**, Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer**, Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer**, P.K. Nag, Tata McGraw Hill 2002.

FINITE ELEMENT METHODS

Sub Code	: 10ME 64	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT-1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

UNIT-2

Basic Procedure: Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

UNIT-3

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

UNIT-4

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique.

06 Hrs

PART-B

UNIT-5

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

UNIT-6

Trusses: Stiffness matrix of Truss element. Numerical problems.

06 Hrs

UNIT-7

Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.

06 Hrs

UNIT-8

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs**TEXT BOOKS:**

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

MECHATRONICS & MICROPROCESSOR

Sub Code	: 10ME 65	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

Introduction to Mechatronic Systems: Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours**UNIT - 2**

Review of Transducers and Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours

UNIT 3

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

06 Hours**UNIT - 4**

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation.

07 Hours**PART - B****UNIT - 5**

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

07 Hours**UNIT - 6**

Logic Function: Data word representation. Basic elements of control systems 808SA processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

07 Hours**UNIT - 7**

Organization & Programming of Microprocessors: Introduction to organization of INTEL 808S-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

06 Hours**UNIT - 8**

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

06 Hours

TEXT BOOKS:

1. **Mechatronics**, W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming And Applications With 8085/8085A**, R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics and Microprocessors**, K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran, Wiley, 1st Ed, 2009
2. **Mechatronics - Principles, Concepts and applications** – Nitaigour and Premchand Mahilik - Tata McGraw Hill- 2003.
3. **Mechatronics Principles & applications**, Godfrey C. Onwubolu, Elsevier..
4. **Introduction Mechatronics & Measurement systems**, David.G. Aliciatore & Michael. B. Bihistaned, Tata McGraw Hill, 2000.

HEAT & MASS TRANSFER LABORATORY

Sub Code	: 10MEL 67	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.

21 Hours**PART - B**

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour

4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air - Conditioner
6. Experiment on Transient Conduction Heat Transfer

21 Hours**Scheme for Examination:**

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

Sub Code	: 10MEL 68	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A**Study of a FEA package and modeling stress analysis of**

- a. Bars of constant cross section area, tapered cross section area and stepped bar
6 Hours
- b. Trusses – (Minimum 2 exercises)
3 Hours
- c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc (Minimum 6 exercises)
12 Hours

PART - B

- a) Stress analysis of a rectangular plate with a circular hole
3 Hours
- b) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 4 exercises)
9 Hours

- c) Dynamic Analysis
- 1) Fixed – fixed beam for natural frequency determination
 - 2) Bar subjected to forcing function
 - 3) Fixed – fixed beam subjected to forcing function

9 Hours

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomason, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

ELECTIVE-II (GROUP - A)

REFRIGERATION AND

AIR CONDITIONING

Sub Code	: 10ME 663	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Methods Of Refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration.

06 Hours

UNIT – 2

Gas Cycle Refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages & dis-advantages of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numericals.

06 Hours

UNIT – 3

Multi Pressure Vapour Compression Systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid

carbon dioxide, System practices for multistage system.

07 Hours

UNIT - 4

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures

07 Hours

PART - B

UNIT – 5

Equipments Used In Vapour Compression Refrigeration System: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

06 Hours

UNIT - 6

Vapour Absorption System: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

07 Hours

UNIT - 7

Design Conditions: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

Load Calculations And Applied Psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

07 Hours**UNIT - 8**

Transmission And Distribution Of Air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

Controls In Refrigeration And Air Conditioning Equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

06 Hours**TEXT BOOKS:**

1. ‘**Refrigeration and Air-Conditioning**’ C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
2. ‘**Refrigeration and Air-Conditioning**’ W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.
3. **ASHRAE**, Hand Book, 2009

REFERENCE BOOKS:

1. ‘**Principles of Refrigeration**’ Dossat, Pearson-2006.
2. ‘**Heating, Ventilation and Air Conditioning**’, McQuiston, Wiley Students edition, 5th edition 2000.
3. ‘**Air conditioning**’ PITA, 4th edition, pearson-2005
4. ‘**Refrigeration and Air-Conditioning**’ Manohar prasad
5. ‘**Refrigeration and Air-Conditioning**’ S C Arora & S Domkundwar, Dhanpat Rai Publication

NON-TRADITIONAL MACHINING

Sub Code	: 10ME 665	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.

05 Hours

UNIT - 2

Ultrasonic Machining (Usm): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hours

UNIT - 3

Abrasive Jet Machining (Ajm): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

07 Hours

UNIT - 4

Electrochemical Machining (Ecm): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

06 Hours

PART - B**UNIT - 5**

Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

06 Hours**UNIT - 6**

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

08 Hours**UNIT - 7**

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hours**UNIT - 8**

Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

07 Hours**TEXT BOOKS:**

1. **Modern machining process**, Pandey and Shan, Tata McGraw Hill 2000
2. **New Technology**, Bhattacharya 2000

REFERENCE BOOKS:

1. **Production Technology**, HMT Tata McGraw Hill. 2001

2. **Modern Machining Process**, Aditya. 2002
3. **Non-Conventional Machining**, P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook: Machining Volume 16**, Joseph R. Davis (Editor), American Society of Metals (ASM)

ENGINEERING ECONOMY

Sub Code	: 10ME 71	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3

Equivalent Annual-Worth Comparisons: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4

Rate-Of-Return Calculations And Depreciation: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5

Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6

Introduction, Scope Of Finance, Finance Functions: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7

Financial Ratio Analysis: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

Financial And Profit Planning: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy**, Riggs J.L., 4TH ed. , McGraw Hill, 2002
2. **Engineering Economy**, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy**, Tarachand, 2000.
2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000
3. **Financial Mangement**, Prasanna Chandra, 7th Ed., TMH, 2004
4. **Finacial Management**, IM PANDEY, Vikas Pub. House, 2002

MECHANICAL VIBRATIONS

Sub Code	: 10ME 72	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations**, S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations**, V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications**, W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations**, G. K. Grover, Nem Chand and Bros, 6th edition, 1996.

HYDRAULICS AND PNEUMATICS

Sub Code	: 10ME 73	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double - Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.

Compressed Air: Production of compressed air- Compressors Preparation of compressed air-Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

06 Hours

TEXT BOOKS:

1. **“Fluid Power with Applications”**, Anthony Esposito, Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics'**, Andrew Parr, Jaico Publishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata McGraw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks'** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems'**, S. R. Majumdar, Tata McGraw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

OPERATION RESEARCH

Sub Code	: 10ME 74	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

Solution Of Linear Programming Problems: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

Integer Programming: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

Pert-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

Sequencing: Basic assumptions, sequencing „n“ jobs on single machine using priority rules, sequencing using Johnson“s rule-„n“ jobs on 2 machines, „n“ jobs on 3 machines, „n“ jobs on „m“ machines. Sequencing 2 jobs on „m“ machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research**, P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research**, Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research**, A P Verma, S K Kataria & Sons, 2008
2. **Operations Research**, Paneerselvan, PHI
3. **Operations Research**, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research**, Hillier and Liberman, 8th Ed., McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

DESIGN LABORATORY

Sub Code	: 10MEL 77	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
 - a) Circular disc subjected to diametral compression.
 - b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:

One question from Part A -	20 Marks (05 Write up +15)
One question from Part B -	20 Marks (05 Write up +15)
Viva - Voce -	10 Marks

Total: 50 Marks

CIM & AUTOMATION LAB

Sub Code	: 10MEL 78	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master- CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examination:

Two questions from Part A - 40 Marks (20 Write up +20)
Viva - Voce - 10 Marks

Total: 50 Marks

NON-CONVENTIONAL ENERGY RESOURCE

Sub Code	: 10ME 754	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Subject Code	:	10ME754	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Letter

TOTAL QUALITY MANAGEMENT

Sub Code	: 10ME 758	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction : customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5

Quality Management Tools : Why Why, forced field analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6

Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7

Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Bald ridge, and sis sigma, a view toward the future.

07

Hours

UNIT - 8

Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
2. **100 Methods for Total Quality Management:** Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1
3. **Organisational Excellence through TQM,** H. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)
EXPERIMENTAL STRESS ANALYSIS

Sub Code	: 10ME 761	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

06 Hours

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photo-elasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photo-elasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photo-elastic model materials, Materials for 2D photo-elasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photo-elasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings. **08 Hours**

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. "Experimental Stress Analysis", Dally and Riley, McGraw Hill.
2. "Experimental Stress Analysis". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata McGraw Hill.

REFERENCES BOOKS :

1. "Photoelasticity Vol I and Vol II, M.M.Frocht, John Wiley & sons.
2. "Strain Gauge Primer", Perry and Lissner,
3. "Photo Elastic Stress Analysis", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "Motion Measurement and Stress Analysis", Dave and Adams,

OPERATION MANAGEMENT

Sub Code	: 10ME 81	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT 1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, 9th Ed., Tata McGraw Hill.
2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management**, Norman Gaither & Greg Frazier,
2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.
3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	: 10ME 82	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems,** Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control,** Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System,** Schaum"s series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	: 10ME 831	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton"s Law of viscosity, Hagen-Poiseuille Law, Flow between

parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hours**

UNIT - 2

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D. **06 Hours**

UNIT - 3

Idealized Journal Bearing: introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems. **07 Hours**

UNIT - 4

Slider / Pad Bearing With A Fixed And Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples. **07 Hours**

PART - B

UNIT - 5

Oil Flow And Thermal Equilibrium Of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. **06 Hours**

UNIT - 6

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing. **06 Hours**

UNIT - 7

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials. **07 Hours**

UNIT - 8

Behavior Of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering **07 Hours**

TEXT BOOKS:

1. **Fundamentals of Tribology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006

2. **Introduction to Tribology Bearings**, Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENC BOOKS:

1. **Theory and Practice of Lubrication for Engineers**, Fuller, D., New York company 1998
2. **Principles and Applications of Tribology**, Moore, Pergamon press 1998
3. **Tribology in Industries**, Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design**, Redzimoskay E I., Oxford press company 2000

POWER PLANT ENGINEERING

Sub Code	: 10ME 833	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1

Steam Power Plant:

Different types of fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverised fuel, Equipment for preparation and burning of pulverised coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace.

7 Hrs

UNIT 2

Coal, Ash Handling and Different Types of Boilers :

Coal and Ash handling, Generation of steam using forced circulation, high and supercritical pressures, A brief account of L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators.

6 Hrs

UNIT 3

Chimneys, Accessories for the Steam Generator Cooling Towers And Ponds:

Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft. Accessories For The Steam Generator such as super-heaters, desuperheater, control of super heaters, Economisers, Air Pre-heaters Study of different types of cooling towers and ponds.

6 Hrs

UNIT 4

Diesel Engine and Gas Turbine Power Plant:

Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, Intake and exhaust system, Layout of a diesel power plant. Advantages and disadvantages of the gas turbine plant, Open and closed cycle turbine plants with the accessories.

7Hrs

PART – B

UNIT 5

Hydro-Electric Plants: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, gates and valves, power house,

general layout. A brief description of some of the important Hydel Installations in India.

7Hrs

UNIT 6

Nuclear Power Plant: Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the Nuclear reactor, Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types - Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Radio active waste disposal.

7 Hrs

UNIT 7

Choice of site for power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, Effect of variable load on power plant, selection of the number and size of units.

6 Hrs

UNIT 8

Economic Analysis of power plant: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, tariffs for electrical energy.

6 Hrs

TEXT BOOKS:

1. **Power Plant Engineering**, P.K Nag, 3rd Ed. Tata McGraw Hill 2nd ed 2001,
2. **Power Plant Engineering**. Morse F.T., Van Nstrand.1998

REFERENCE BOOKS:

1. **Water Power Engg.**, Edition 3, Barrows, TMH, New Delhi. 1998
2. **Plant Engg. Hand Book**, Stanier, McGraw Hill. 1998
3. **Hydraulic Machines**, Jagadish Lal, Metropolitan Co 1996.
4. **Principles of Energy Conversion**, A.W. Culp Jr., McGraw Hill. 1996
5. **Power Plant Technology**, M.M. EL-Wakil, McGraw Hill, International. 1994
6. **Power Station Engg. Economics**, Skrotizke and V opat. 1994
7. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons.2003

ELECTIVE-II (GROUP - E)

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 844	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Engine Components And Cooling & Lubrication Systems: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

Fuels, Fuel Supply Systems For Si And Ci Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

Power Trains: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

Drive To Wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

Suspension, Springs And Brakes: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

Automotive Emission Control Systems: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics**, William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007
2. **Automotive Mechanics**, S. Srinivasan, 2nd Ed., Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc
2. **Fundamentals of Automobile Engineering**, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.
4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 845	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Database And Database Users: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

06 Hours

UNIT - 2

Database Systems Concepts And Architecture: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

06 Hours

UNIT - 3

Data Modeling: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

08 Hours

UNIT - 4

Record Storage And Primary File Organizations: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

06 Hours

PART - B

UNIT - 5

Relational Data Model And Relational Algebra: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.

07 Hours

UNIT - 6

Structural Query Language (Sql): Data definition etc., in SQL2. Basic and complex queries in SQL, Inset, Delete; Update statements, and views in SQKL, embedded SQL.

07 Hours

UNIT - 7

Database Design: Design guidelines for relational schemas, functional dependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

07 Hours

UNIT - 8

System Implementation: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems**, Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System**, Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design**, Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems**, Designing and Building business applications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM**, Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME51	Management and Engineering Economics	3	2	0	03	80	20	100	4
2	15ME52	Dynamics of Machinery	3	2	0	03	80	20	100	4
3	15ME53	Turbo Machines	3	2	0	03	80	20	100	4
4	15ME54	Design of Machine Elements - I	3	2	0	03	80	20	100	4
5	15ME55X	Professional Elective-I	3	0	0	03	80	20	100	3
6	15ME56X	Open Elective-I	3	0	0	03	80	20	100	3
7	15MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	80	20	100	2
8	15MEL58	Energy Lab	1	0	2	03	80	20	100	2
TOTAL			21	06	04		640	160	800	26

Professional Elective-I		Open Elective-I	
15ME551	Refrigeration and Air-conditioning	15ME562	Energy and Environment
15ME554	Non Traditional Machining		

1. **Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
2. **Professional Elective:** Elective relevant to chosen specialization/ branch
3. **OpenElective:** Electives from other technical and/or emerging subject areas.

MANAGEMENT AND ENGINEERING ECONOMICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Management And Engineering Economics	15ME51	04	3-2-0	80	20	3Hrs

MODULE – 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought- early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans. **10 Hours**

MODULE - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief) **10 Hours**

MODULE -3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity.

Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems **10 Hours**

MODULE -4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems **10 Hours**

MODULE -5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems. **10 Hours**

Course outcomes

On completion of this subject students will be able to

1. Understand needs, functions, roles, scope and evolution of Management
2. Understand importance, purpose of Planning and hierarchy of planning and also analyze its types
3. Discuss Decision making, Organizing, Staffing, Directing and Controlling
4. Select the best economic model from various available alternatives
5. Understand various interest rate methods and implement the suitable one.
6. Estimate various depreciation values of commodities
7. Prepare the project reports effectively.

TEXT BOOKS

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Dynamics of Machinery	15ME52	04	3-2-0	80	20	3Hrs

Course Objectives

1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.
2. Analyse the mechanisms for static and dynamic equilibrium.
3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.
4. Analyse the balancing of rotating and reciprocating masses, governors and gyroscopes.
5. To understand vibrations characteristics of single degree of freedom systems.
6. Characterise the single degree freedom systems subjected to free and forced vibrations with and without damping.

MODULE 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

10 Hours

MODULE 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

10 Hours

MODULE 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

10 Hours

MODULE - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

10 Hours

MODULE – 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

10 Hours

Course outcomes

On completing the course the student will be able to

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

Text Books:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K. Grover, Nem Chand and Bros.

Reference Books:

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Turbo Machines	15ME53	04	3-2-0	80	20	3Hrs

Course Objectives:

- The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.
- Explain the working principles of turbomachines and apply it to various types of machines
- It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.

Module 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process **(10 Hours)**

Module 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

(10 Hours)

Module 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

(10 Hours)

Module 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and**

Propeller turbines - velocity triangles, design parameters. Problems. **(10 Hours)**

Module 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

(10 Hours)

Course Outcomes:

- Able to give precise definition of turbomachinery
- Identify various types of turbo machinery
- Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
- Understand the principle of operation of pumps, fans, compressors and turbines.
- Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)
- Analyze the performance of turbo machinery.

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).

3. Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements	15ME54	04	3-2-0	80	20	3Hrs

Course Objectives

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module-1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.

Static Stresses: Static loads .Normal, Bending, Shear and Combined stresses. Stress concentration and determination of stress concentration factor.

10 Hours

Module -2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.

Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

10Hours

Module -3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads.

Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

10 Hours

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

10 Hours

Module -5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

10 Hours

Course outcomes

On completion of the course the student will be able to

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

Text Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

Reference Books:

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
(Professional Elective-I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Refrigeration And Air-Conditioning	15ME551	03	3-0-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course objectives

1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems
2. Understand the working principles and applications of different types of refrigeration systems
3. Study the working of air conditioning systems and their applications
4. Identify the performance parameters and their relations of an air conditioning system

Module – I

Introduction to Refrigeration –Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications:Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing and food chain, Miscellaneous
8 Hours

Module – II

Vapour Compression Refrigeration System(VCRS): Comparison of Vapour Compression Cycle and Gas cycle,Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency,Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP – Ewing’s construction and Gosney’s method.Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure,Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

10 Hours

Module – III

Vapour Absorption Refrigeration Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.Practical problems – crystallization and air leakage, Commercial systems

Other types of Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermo acoustic refrigeration systems

8

Hours

Module – IV

Refrigerants:Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

8 Hours

Module – V

Air-Conditioning: Introduction to Air-Conditioning, Basic Definition, Classification, power rating, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapour compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

Data Book:

1. Shan K. Wang, Handbook of Air Conditioning and Refrigeration, 2/e, 2001 McGraw-Hill Education
2. Mathur M.L. & Mehta, Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, F.S., Jain Brothers, 2008

E- Learning

- VTU, E- learning, MOOCS, Open courseware

**NON TRADITIONAL MACHINING
(Professional Elective-I)**

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Non Traditional Machining	15ME554	03	3-0-0	80	20	3Hrs

**MODULE 1
INTRODUCTION**

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes. **08 hours**

MODULE 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

08 hours

MODULE 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

10 hours

MODULE 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

08 hours

MODULE 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

08 hours

Course Outcomes

On completion of the course, the students will be able to

1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.
2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

Text Books:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

Reference Books

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
(OPEN ELECTIVE – I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy And Environment	15ME562	03	3-0-0	80	20	3Hrs

Course Objectives

1. Understand energy scenario, energy sources and their utilization
2. Learn about methods of energy storage, energy management and economic analysis
3. Have proper awareness about environment and eco system.
4. Understand the environment pollution along with social issues and acts.

Module – I

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment. **8 Hours**

Module – II

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems

Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing

Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries

Economic Analysis: Scope, Characterization of an Investment Project

10 Hours

Module – III

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.

Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. **8 Hours**

Module – IV

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies. **8 Hours**

Module – V

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS:

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S rao, New Age Inytermnational, 2006, reprint 2015, 2nd edition
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

E- Learning

- India Energy Outlook 2015(www.iea.org/.../IndiaEnergyOutlook_WEO2015.pdf)
- Open courseware

FLUID MECHANICS & MACHINERY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Mechanics & Machinery Lab	15MEL57	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Turbo Machines

Prerequisites : Fluid Mechanics and Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART – B

7. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
8. Performance hydraulic Pumps
 - d. Single stage and Multi stage centrifugal pumps
 - e. Reciprocating pump
9. Performance test on a two stage Reciprocating Air Compressor
10. Performance test on an Air Blower

PART – C (Optional)

11. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
12. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course Outcomes:

At the end of this course students are able to,

1. Perform experiments to determine the coefficient of discharge of flow measuring devices.
2. Conduct experiments on hydraulic turbines and pumps to draw characteristics.
3. Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
4. Determine the energy flow pattern through the hydraulic turbines and pumps
5. Exhibit his competency towards preventive maintenance of hydraulic machines

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 25 Marks
ONE question from part -B: 40 Marks
Viva –Voice : 15 Marks
Total: 80 Marks

ENERGY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Lab	15MEL58	02	1-0-2	80	20	3Hrs

Prerequisites: Basic and Applied Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
3. Exhaust emissions of I C Engines will be measured and compared with the standards.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART - B

7. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
8. Measurements of Exhaust Emissions of Petrol engine.
9. Measurements of Exhaust Emissions of Diesel engine.
10. Measurement of $p\theta$, pV plots using Computerized IC engine test rig

PART – C (Optional)

11. Visit to Automobile Industry/service stations.
12. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course Outcomes: At the end of this course students are able to,

1. Perform experiments to determine the properties of fuels and oils.
2. Conduct experiments on engines and draw characteristics.
3. Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
4. Identify exhaust emission, factors affecting them and report the remedies.
5. Determine the energy flow pattern through the I C Engine
6. Exhibit his competency towards preventive maintenance of IC engines.

References

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) – USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai& sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 25 Marks
ONE question from part -B: 40 Marks
Viva –Voice : 15 Marks
Total: 80 Marks

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME61	Finite Element Analysis	3	2	0	03	80	20	100	4
2	15ME62	Computer integrated Manufacturing	4	0	0	03	80	20	100	4
3	15ME63	Heat Transfer	3	2	0	03	80	20	100	4
4	15ME64	Design of Machine Elements -II	3	2	0	03	80	20	100	4
5	15ME65X	Professional Elective-II	3	0	0	03	80	20	100	3
6	15ME66X	Open Elective-II	3	0	0	03	80	20	100	3
7	15MEL67	Heat Transfer Lab	1	0	2	03	80	20	100	2
8	15MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	80	20	100	2
TOTAL			21	6	04		640	160	800	26

Professional Elective-II		Open Elective-II	
15ME653	Metal Forming	15ME664	Total Quality Management
15ME655	Automobile Engineering		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

FINITE ELEMENT ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Finite Element Analysis	15ME61	04	3-2-0	80	20	3Hrs

Course Objectives:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Module I

Introduction to Finite Element Method :General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems. Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

10 Hours

Module II

One-Dimensional Elements-Analysis of Bars and Trusses,

Linear interpolation polynomials in terms of local coordinate's for 1D, 2D elements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, , , Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA

8), 2D isoparametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Fore terms: Body force, traction force and point loads,

Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses.

10 Hours

Module III

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.

Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

08 Hours

Module IV

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic net works.

10 Hours

Module V

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.

Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind formulation methods in FEM.
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
3. Develop element characteristic equation and generation of global equation.
4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

12Hours

Text Books:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergaman Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

Reference Books:

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing	15ME62	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
CLO2	To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
CLO3	To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
CLO4	To expose students to computer aided process planning, material requirement planning, capacity planning etc.
CLO5	To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
CLO6	To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module - 1

1. Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems. **5 Hours**

2. Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems. **5 Hours**

Module – 2

3. CAD and Computer Graphics Software:The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

5 Hours

4. Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

5 Hours

Module- 3

5. Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

5 Hours

6. Line Balancing: Linebalancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line balancing, computerized line balancing methods.

5 Hours

Module-4.

7. Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

5 Hours

8. Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: material handling, processing and assembly and inspection.

5 Hours

Module – 5

9. Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing. **5 Hours**

10. Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems. **5 Hours**

Course Outcomes:

After studying this course, students will be able to:

CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen.
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
CO3	Analyze the automated flow lines to reduce down time and enhance productivity.
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Text Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

Reference Books:

1. “CAD/CAM” by Ibrahim Zeid, Tata McGraw Hill.
2. “Principles of Computer Integrated Manufacturing”, S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.

3. “Work Systems And The Methods, Measurement And Management of Work”, Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. “Computer Automation in Manufacturing”, Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. “Introduction to Robotics: Mechanics And Control”, Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. **“Understanding Additive Manufacturing”**, Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer	15ME63	04	3-2-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course learning objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module – I

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel. **8 Hours**

Module – II

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts. **9 Hours**

Module – III

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction, one dimensional unsteady conduction, two-dimensional steady and unsteady conduction, the difference equation, boundary conditions, solution methods, cylindrical coordinates and irregular boundaries.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield. **9 Hours**

Module – IV

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

8 Hours

Module – V

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers.

Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

9 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Understand the basic modes of heat transfer.
- Compute temperature distribution in steady-state and unsteady-state heat conduction
- Understand and interpret heat transfer through extended surfaces.
- Interpret and compute forced and free convective heat transfer.
- Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
- Design heat exchangers using LMTD and NTU methods.

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.

REFERENCE BOOKS:

1. Heat and mass transfer, Kurt C. Rolfe, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sagma, Bookboon.com

MOOCs:

1. Fluid flow, Heat and Mass Transfer- <http://ocw.tudelft.nl/courses/applied-earth-sciences/fluid-flow-heat-mass-transfer/course>
2. Heat transfer course- <https://legacy.saylor.org/me204/Intro/>

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN OF MACHINE ELEMENTS II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements II	15ME64	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To understand various elements involved in a mechanical system.
CLO2	To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
CLO3	To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
CLO4	To design completely a mechanical system integrating machine elements.
CLO5	To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

MODULE I

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

08 Hours

MODULE 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains. (Only theoretical treatment)

Springs:Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs;springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs,equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

10 Hours

MODULE 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

12 Hours

MODULE 4

Worm Gears:Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches:Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes:Types of Brakes, Block and Band brakes,selflocking of brakes, and heat generation in brakes.

10 Hours

MODULE 5

Lubrication and Bearings:Lubricants and their properties, bearing materials and properties;mechanisms of lubrication,hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.

Numerical examples on hydrodynamic journal and thrust bearing design.

Anti friction bearings:Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

10 Hours

Course Outcomes:

After learning the course the students should be able to:

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs,belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers, catalogue.
C07	Develop proficiency to generate production drawings using CAD software.
C08	Become good design engineers through learning the art of working in a team with morality and ethics.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, single plate clutch, etc.)A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings,completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit (5 marks) in internal assessment.

Textbooks:

- [1] Richard G. Budynas,and J. Keith Nisbett,“Shigley's Mechanical Engineering Design”, McGraw-Hill Education, 10th Edition, 2015.
- [2] Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, Wiley student edition, 2007.
- [3] V. B. Bhandari, “*Design of Machine Elements*”,4th Ed., Tata Mcgraw Hill, 2016.

References:

- [1] Robert L. Norton “Machine Design- an integrated approach”, Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E “Design and Machine Elements”, Pearson Education, 8th edition,2006.
- [3] Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.

[4] Hall, Holowenko, Laughlin (Schaum's Outline Series), "Machine design" adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.

[5] G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill, 2nd edition,2004.

Design Data Hand Book:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010

[4]PSG Design Data Hand Book, PSG College of technology, Coimbatore.

METAL FORMING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Metal Forming	15ME653	3	3-0-0	80	20	3Hrs

Course objectives:

The course is intended to provide basic understanding of Metal Forming with following aspects:

- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes
- Understanding plastic deformation during forming processes

MODULE -1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties. **10 Hrs**

MODULE -2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems. **10 Hrs**

MODULE -3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems. **10 Hrs**

MODULE -4

Extrusion:Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems. **10 Hrs**

MODULE -5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations. **10 Hrs**

Course outcomes:

On completion of this subject, students will be:

2. Able to understand the concept of different metal forming process.
3. Able to approach metal forming processes both analytically and numerically
4. Able to design metal forming processes
5. Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuwanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS:

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K , Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

AUTOMOBILE ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam duration
				SEE	CIA	
Automobile	15ME655	3	3-0-0	80	20	3 Hrs

Course learning objectives: The student will be able to learn

- The layout and arrangement of principal parts of an automobile
- The working of transmission and brake systems
- The operation and working of steering and suspension systems
- To know the Injection system and its advancements
- To know the automobile emissions and its effects on environment

MODULE 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system. **10 Hours**

MODULE 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical **08 Hours**

MODULE 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system. **08 Hours**

MODULE 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

08 Hours

MODULE 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

08 Hours

Course Outcomes: Student will be able

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, Satya Prakashan,(4th Edition) 1984.

TOTAL QUALITY MANAGEMENT

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Total Quality Management	15ME664	03	3-0-0	80	20	3Hrs

COURSE LEARNING OBJECTIVES:

This course enables students to

1. Understand various approaches to TQM
2. Understand the characteristics of quality leader and his role.
3. Develop feedback and suggestion systems for quality management.
4. Enhance the knowledge in Tools and Techniques of quality management

Module - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

08 Hours

Module - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

08 Hours

Module - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

08 Hours

Module - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, and qualityfunction deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

08 Hours

COURSE OUTCOMES:

Student will be able to

1. Explain the various approaches of TQM
2. Infer the customer perception of quality
3. Analyze customer needs and perceptions to design feedback systems.
4. Apply statistical tools for continuous improvement of systems
5. Apply the tools and technique for effective implementation of TQM.

TEXT BOOKS:

1. Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. Managing for Quality and Performance Excellence by James R.Evans and Williuam M Lindsay,9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, ShojiShiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Reference Books:

1. Engineering Optimization Methods and Applications, A Ravindran, K, M.Ragsdell, Willey India Private Limited,2nd Edition,2006.
2. : Introduction to Operations Research- Concepts and Cases, F.S. Hillier. G.J. Lieberman, 9th Edition, Tata McGraw Hill. 2010.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Heat Transfer Lab

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer Lab	15MEL67	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Heat Transfer

Course Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Steffan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.
7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course Outcomes: At the end of this course students are able to,

- Perform experiments to determine the thermal conductivity of a metal rod

- Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
- Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
- Determine surface emissivity of a test plate
- Estimate performance of a refrigerator and effectiveness of fin
- Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

Modeling and Analysis Lab (FEA)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Modeling and Analysis Lab	15MEL68	02	1-0-2	80	20	3Hrs

CREDITS – 02

Prerequisites: Knowledge of any Modeling software, knowledge of coordinate systems and Geometric transformations etc.

Course objectives:

The course is intended to provide basic understanding of Modeling and Analysis techniques students with following aspects:

- To acquire basic understanding of Modeling and Analysis software
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

PART – A

Study of a FEA package and modeling and stress analysis of:

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load , UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART - B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination

- b) Bar subjected to forcing function
- c) Fixed – fixed beam subjected to forcing function

PART – C (only for demo and oral exam)

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course Outcomes: At the end of the course the students are able to:

- Demonstrate the basic features of an analysis package.
- Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.
- Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
- Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
- Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 32 Marks (08 Write up +24)

One Question from Part B - 32 Marks (08 Write up +24)

Viva-Voce - 16 Marks

Total 80 Marks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME71	Energy Engineering	3	2	0	03	80	20	100	4
2	15ME72	Fluid Power Systems	4	0	0	03	80	20	100	4
3	15ME73	Control Engineering	3	2	0	03	80	20	100	4
4	15ME74X	Professional Elective - III	3	0	0	03	80	20	100	3
5	15ME75X	Professional Elective-IV	3	0	0	03	80	20	100	3
6	15MEL76	Design Lab	1	0	2	03	80	20	100	2
7	15MEL77	CIM Lab	1	0	2	03	80	20	100	2
8	15MEP78	Project Phase – I	-	-	-	-	-	100	100	2
TOTAL			18	4	04		560	240	800	24

Professional Elective-III		Professional Elective-IV	
15ME742	Tribology	15ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

ENERGY ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Engineering	15ME71	04	3-2-0	80	20	3Hrs

Course learning objectives is to

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods and their analysis
- Study the principles of renewable energy conversion systems
- Understand the concept of green energy and zero energy.

Module – I

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

9 Hours

Module – II

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

7 Hours

Module – III

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

8 Hours

Module – IV

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

8 Hours

Module – V

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Summarize the basic concepts of thermal energy systems,
- Identify renewable energy sources and their utilization.
- Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
- Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
- Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
- Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS:

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

Scheme of Examination: Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

FLUID POWER SYSTEMS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Power Systems	15ME72	04	3-2-0	80	20	3Hrs

Course objectives:

CLO1	To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
CLO2	To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
CLO3	To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
CLO4	Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
CLO5	To familiarize with logic controls and trouble shooting

Module 1: Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

10 hours

Module 2: Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

10 hours

Module 3: Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design:Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application,hydrauliccylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for force multiplication;speedcontrol of hydraulic cylinder- metering in, metering out and bleed off circuits.Pilot pressure operated circuits.Hydraulic circuit examples withaccumulator.

10 hours

Module4: Pneumatic power systems

Introduction to Pneumatic systems:Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

10 hours

Module5: Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

10 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Identify and analyse the functional requirements of a fluid power transmission system for a
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	given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000 .
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2002 .
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS:

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol I, II and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

- a. Speed control circuit using metering in and metering out technique
- b. Regenerative and sequencing circuits.
- c. Extend-Retract and Stop system of a linear actuator
- d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

- a. Automatic reciprocating circuit
- b. Speed control circuit
- c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
- d. Electro pneumatic valves and circuit

Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment (5 Marks).

List of Open Source Software/learning website:

1. Simulink
2. SimHydraulics

CONTROL ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Control Engineering	15ME73	04	3-2-0	80	20	3Hrs

Course Objectives	<ol style="list-style-type: none"> 1. Modeling of mechanical, hydraulic, pneumatic and electrical systems. 2. Representation of system elements by blocks and its reduction 3. Transient and steady state response analysis of a system. 4. Frequency response analysis using polar plot. 5. Frequency response analysis using bode plot. 6. Analysis of system using root locus plots. 7. Different system compensators and variable characteristics of linear systems.
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MODULE I

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

(7 Hours)

MODULE 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.
(3 hours)

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

(4 hours)

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

(6 Hours)

MODULE 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.
(3 hours)

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.
(4 hours)

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation
(6 Hours)

MODULE 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins
(14 Hours)

MODULE 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test .

(7 Hours)

Course Outcomes
CO1: Recognize control system and its types , control actions
CO2: Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3: Calculate the gain of the system using block diagram and signal flow graph
CO4: Illustrate the response of 1st and 2nd order systems
CO5: Determine the stability of transfer functions in complex domain and frequency domain
CO6: Employ state equations to study the controllability and observability

TRIBOLOGY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Tribology	15ME742	03	3-0-0	80	20	3Hrs

Course objectives:

CLO1	To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.
CLO2	To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
CLO3	To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
CLO4	To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
CLO5	To introduce the concepts of surface engineering and its importance in tribology.

Module 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

8 hours

Module 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

8 hours

Module 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

10 hours

Module 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

8 hours

Module5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapor phase processes.

Selection of coating for wear and corrosion resistance.

8 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Use of approved Design Data Handbook/charts can be permitted during the examination.

TEXTBOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCES:

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Mechatronics	15ME753	03	3-0-0	80	20	3 Hrs

Course objectives:

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Understand the applications of microprocessors in various systems and to know the functions of each element
4. Demonstrate the integration philosophy in view of Mechatronics technology

MODULE -1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors. 10 Hours

MODULE -2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor. 10 Hours

MODULE -3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot. 10 Hours

MODULE -4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors. 10 Hours

MODULE -5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve,

solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

10 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Develop mechanical, hydraulic, pneumatic and electrical control systems.

TEXT BOOKS:

1. NitaigourPremchandMahalik , Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1stEdition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W.Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1stEdition, 2005 ISBN No. 81-7758-284-4.

REFERENCE BOOKS:

1. Mechatronics by HMT Ltd. – Tata McGrawHill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power , Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN LABORATORY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design Laboratory	15MEL76	02	1-0-2	80	20	3Hrs

Prerequisites: Knowledge of Dynamics and Machines and Design of Machine Elements

COURSE OBJECTIVES:

Students are expected-

1. To understand the natural frequency, logarithmic decrement, damping ratio and damping.
2. To understand the balancing of rotating masses.
3. To understand the concept of the critical speed of a rotating shaft.
4. To understand the concept of stress concentration using Photo elasticity.
5. To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART –A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART –B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.
5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

Scheme of Examination:

One question from Part A:	32 Marks
One question from part B:	32 Marks
Viva- Voce:	16 Marks
Total:	80 Marks

Reference Books:

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

COMPTER INTEGRATED MANUFACTURING LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing LAB	15MEL77	02	1-0-2	80	20	3Hrs

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes.
CLO2	To educate the students on the usage of CAM packages.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations.

3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master- CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Cut the part in single block and auto mode and measure the virtual part on screen.

Post processing of CNC programs for standard CNC control systems like FANUC, SINUMERIC and MISTUBISHI.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time.
CLO6	Understand & write programs for Robotcontrol; understand the operating principles of hydraulics, pneumatics and electropneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	15MEP78	2	0-3-0	100	-	-

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME81	Operations Research	3	2	0	03	80	20	100	4
2	15ME82	Additive Manufacturing	4	0	0	03	80	20	100	4
3	15ME83X	Professional Elective - V	3	0	0	03	80	20	100	3
4	15ME84	Internship / Professional Practice	Industry Oriented			03	50	50	100	2
5	15ME85	Project Phase – II	-	6	-	03	100	100	200	6
6	15MES86	Seminar	-	4	-	-	-	100	100	1
TOTAL			10	12	-		390	310	700	20

Professional Elective-V	
15ME832	Experimental Stress Analysis

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th& 7th semester vacation or 7th& 8th semester vacation.

OPERATIONS RESEARCH

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Operations Research	15ME81	4	3-2-0	80	20	3 Hrs

Course objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

MODULE -1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR,

Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

08 Hours

MODULE -2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

12 Hours

MODULE -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems.

Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

12 Hours

MODULE -4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models. 10 Hours

MODULE -5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method. 08 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD.

Publications, New Delhi – 2007

2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8thEd., McGraw Hill

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

ADDITIVE MANUFACTURING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Additive Manufacturing	15ME82	4	4-0-0	80	20	3 Hrs

Course Objectives:

Students will be able to

1. Understand the additive manufacturing process, polymerization and powder metallurgy process
2. Understand characterisation techniques in additive manufacturing.
3. Acquire knowledge on CNC and Automation.

Module 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries

10 Hours

Module 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, Triacs, Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

8 Hours

Module 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality,

12 Hours

	<p>Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting. Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.</p>	
Module 4		
	<p>NANO MATERIALS & CHARACTERIZATION TECHNIQUES: Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC). Optical Microscopy - principles, Imaging Modes, Applications, Limitations. Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. Transmission Electron Microscopy (TEM) - principles, Imaging Modes, Applications, Limitations.X- Ray Diffraction (XRD) - principles, Imaging Modes, Applications, Limitations.Scanning Probe Microscopy (SPM) - principles, Imaging Modes, Applications, Limitations, Limitations.Atomic Force Microscopy (AFM) - basic principles, instrumentation, operational modes, Applications, Limitations. Electron Probe Micro Analyzer (EPMA) - Introduction, Sample preparation, Working procedure, Applications, Limitations.</p>	10 Hours
Module 5		
	<p>MANUFACTURING CONTROL AND AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,</p>	10 Hours

	<p>Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)</p> <p>Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity</p> <p>Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.</p>	
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Course Outcomes

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programing and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Experimental Stress Analysis	15ME832	3	3-0-0	80	20	3 Hrs

Course Learning Objectives (CLO's):

1. To use the method of electrical strain gauges to study and characterize the elastic behavior of solid bodies.
2. To measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. To describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
4. To determine stress strain behavior of solid bodies using methods of coating.
5. To conduct stress strain analysis of solid bodies using the methods Holography

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. general consideration in data analysis.

03Hours

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gageconstruction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance' Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

05 Hours

Module -2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

04 Hours

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

02 Hours

Module –3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscopes, Isoclinics&Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials

06Hours

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity

02 Hours

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

04 Hours

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings

06 Hours

Module –5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

05Hours

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

05Hours

Course Outcomes (CO's):

At the end of the course, the student will be able to:

1. Explain characterize the elastic behavior of solid bodies.
2. Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. Discuss skills for experimental investigations an accompanying laboratory course is desirable
4. Discuss experimental investigations by predictions by other methods.
5. Describe various coating techniques.

TEXT BOOKS:

1. "**Experimental Stress Analysis**", Dally and Riley, McGraw Hill.
2. "**Experimental Stress Analysis**". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.

REFERENCES BOOKS :

1. "**Photoelasticity Vol I and Vol II**, M.M.Frocht, John Wiley & sons.
2. "**Strain Gauge Primer**", Perry and Lissner,
3. "**Photo Elastic Stress Analysis**", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "**Motion Measurement and Stress Analysis**", Dave and Adams,
5. **Holman, Experimental Methods for Engineers**, Tata McGraw-Hill Companies, 7th Edition, New York, 2007.
6. **B. C. Nakra and K. K. Chaudhry**, Instrumentation, Measurement and Analysis, Tata McGraw-Hill Companies, Inc, New York, 7th Edition, 2006.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	15ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	15MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	15MES86	1	0-4-0	100	-	-

**B.E. Mechanical Engineering
III SEMESTER**

Sl. No.	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics – III	Maths	04			03	60	40	100	4
2	17ME32	Materials Science	ME	04			03	60	40	100	4
3	17ME33	Basic Thermodynamics	ME	03	02		03	60	40	100	4
4	17ME34	Mechanics of Materials	ME	03	02		03	60	40	100	4
5	17ME35A/ 17ME35B	Metal Casting and Welding	ME	04			03	60	40	100	4
		Machine Tools and Operations	ME								
6	17ME36A/ 17ME36B	Computer Aided Machine Drawing	ME	01		4	03	60	40	100	3
		Mechanical Measurements and Metrology	ME	03							
7	17MEL37A/ 17MEL37B	Materials Testing Lab/	ME	1		2	03	60	40	100	2
		Mechanical Measurements and Metrology Lab	ME								
8	17MEL38A/ 17MEL38B	Foundry and Forging Lab	ME	1		2	03	60	40	100	2
		Machine Shop/	ME								
9	17KL/CPH39 /49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	1			01	30	20	50	1
TOTAL				22/24	04	08/04		510	340	850	28

**B.E. Mechanical Engineering
IV SEMESTER**

Sl. No	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecte	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics – III	Maths	04			03	60	40	100	04
2	17ME42	Kinematics of Machinery	ME	03	02		03	60	40	100	04
3	17ME43	Applied Thermodynamics	ME	03	02		03	60	40	100	04
4	17ME44	Fluid mechanics	ME	03	02		03	60	40	100	04
5	17ME45A/ 17ME45B	Metal Casting and Welding	ME	04			03	60	40	100	04
		Machine Tools and Operations	ME								
6	17ME46 A/ 17ME46B	Computer Aided Machine Drawing	ME	01		4	03	60	40	100	03
		Mechanical Measurements and Metrology	ME	03							
7	17MEL47A/ 17MEL47B	Materials Testing Lab/	ME	1		2	03	60	40	100	02
		Mechanical Measurements and Metrology Lab	ME								
8	17MEL48A/ 17MEL48B	Foundry and Forging Lab	ME	1		2	03	60	40	100	02
		Machine Shop/	ME								
9	17KL/CPH39/ 49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	1			01	30	20	50	1
TOTAL				21/23	06	08/04		510	340	850	28

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME51	Management and Engineering Economics	3	2	0	03	60	40	100	4
2	17ME52	Dynamics of Machinery	3	2	0	03	60	40	100	4
3	17ME53	Turbo Machines	3	2	0	03	60	40	100	4
4	17ME54	Design of Machine Elements - I	3	2	0	03	60	40	100	4
5	17ME55X	Professional Elective-I	3	0	0	03	60	40	100	3
6	17ME56X	Open Elective-I	3	0	0	03	60	40	100	3
7	17MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	60	40	100	2
8	17MEL58	Energy Lab	1	0	2	03	60	40	100	2
TOTAL			20	08	04		480	320	60	40

Professional Elective-I		Open Elective-I	
17ME551	Refrigeration and Air-conditioning	17ME562	Energy and Environment
17ME554	Non Traditional Machining		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Open Elective:** Electives from other technical and/or emerging subject areas.

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME61	Finite Element Analysis	3	2	0	03	60	40	100	4
2	17ME62	Computer integrated Manufacturing	4	0	0	03	60	40	100	4
3	17ME63	Heat Transfer	3	2	0	03	60	40	100	4
4	17ME64	Design of Machine Elements -II	3	2	0	03	60	40	100	4
5	17ME65X	Professional Elective-II	3	0	0	03	60	40	100	3
6	17ME66X	Open Elective-II	3	0	0	03	60	40	100	3
7	17MEL67	Heat Transfer Lab	1	0	2	03	60	40	100	2
8	17MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	60	40	100	2
TOTAL			21	6	04		480	320	60	40

Professional Elective-II		Open Elective-II	
17ME653	Metal Forming	17ME663	Maintenance engineering
17ME655	Automobile Engineering	17ME664	Total Quality Management

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Open Elective:** Electives from other technical and/or emerging subject areas.

CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. Mechanical Engineering

VII semester

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME71	Energy Engineering	3	2	0	03	60	40	100	4
2	17ME72	Fluid Power Systems	4	0	0	03	60	40	100	4
3	17ME73	Control Engineering	3	2	0	03	60	40	100	4
4	17ME74X	Professional Elective - III	3	0	0	03	60	40	100	3
5	17ME75X	Professional Elective-IV	3	0	0	03	60	40	100	3
6	17MEL76	Design Lab	1	0	2	03	60	40	100	2
7	17MEL77	CIM Lab	1	0	2	03	60	40	100	2
8	17MEP78	Project Phase – I	-	-	-	-	60	40	100	2
TOTAL			18	4	04		480	320	60	24

Professional Elective-III		Professional Elective-IV	
17ME742	Tribology	17ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016**

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME81	Operations Research	3	2	0	03	60	40	100	4
2	17ME82	Additive Manufacturing	4	0	0	03	60	40	100	4
3	17ME83X	Professional Elective - V	3	0	0	03	60	40	100	3
4	17ME84	Internship / Professional Practice	Industry Oriented			03	60	40	60	40
5	17ME85	Project Phase – II	-	6	-	03	60	40	200	6
6	17MES86	Seminar	-	4	-	-	60	40	100	1
TOTAL			10	12	-		480	320	700	20
Professional Elective-V										
15ME832			Experimental Stress Analysis							

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th & 7th semester vacation or 7th & 8th semester vacation

MATERIAL SCIENCE

B.E, III Semester, Mechanical Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME32	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.
- Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites.
- The means of modifying such properties, as well as the processing and failure of materials.
- Concepts of use of materials for various applications are highlighted.

Module - 1

Basics, Mechanical Behavior, Failure of Materials

Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion; Factors affecting diffusion.

Mechanical Behavior:

Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and non-linear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals

Fracture: Type I, Type II and Type III,

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness.

Module - 2

Alloys, Steels, Solidification

Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules), Binary phase diagrams: Eutectic, and Eutectoid systems, Lever rule, Substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule Effect of non- equilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Specifications of steels. Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth, Numerical on lever rule

Module - 3

Heat Treatment, Ferrous and Non-Ferrous Alloys

Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel,

Module - 4**Other Materials, Material Selection**

Ceramics: Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics.

Other materials: Smart materials and Shape Memory alloys, properties and applications.

Module - 5**Composite Materials**

Composite materials - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Constitutive relations of composites, Numerical problems on determining properties of composites.

Course outcomes:

- ☐ Describe the mechanical properties of metals, their alloys and various modes of failure.
- ☐ Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.
- ☐ Explain the processes of heat treatment of various alloys.
- ☐ Understand the properties and potentialities of various materials available and material selection procedures.
- ☐ Know about composite materials and their processing as well as applications.

TEXT BOOKS:

1. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.
2. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

REFERENCE BOOKS

1. V.Raghavan, Materials Science and Engineering, , PHI, 2002
2. Donald R. Asklund and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4th Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

BASIC THERMODYNAMICS
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME33	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **Learn about thermodynamic systems and boundaries**
- ▯ **Study the basic laws of thermodynamics including, conservation of mass, conservation of energy or first law , second law and Zeroth law.**
- ▯ **Understand various forms of energy including heat transfer and work**
- ▯ **Identify various types of properties (e.g., extensive and intensive properties)**
- ▯ **Use tables, equations, and charts, in evaluation of thermodynamic properties**
- ▯ **Apply conservation of mass, first law, and second law in thermodynamic analysis of systems (e.g., turbines, pumps, compressors, heat exchangers, etc.)**
- ▯ **Enhance their problem solving skills in thermal engineering**

Module - 1

Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive , extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer

Work and Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention. Problems

L1 , L2

Module - 2

First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation(SFEE), important applications.

Second Law of Thermodynamics: limitations of first law of thermodynamics Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir, Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems

L1 , L2, L3

Module - 3

Reversibility: Definitions of a reversible process, reversible heat engine, importance and superiority of a reversible heat engine and irreversible processes; factors that make a process irreversible, reversible heat engines. Unresisted expansion, remarks on Carnot's engine, internal and external reversibility, Definition of the thermodynamic temperature scale. Problems

Entropy: Clausius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, entropy as a coordinate.

L1 , L2, L3

Module - 4

Availability, Irreversibility and General Thermodynamic relations. Introduction, Availability (Exergy), Unavailable energy, Relation between increase in unavailable energy and increase in entropy. Maximum work, maximum useful work for a system and control volume, irreversibility, second law efficiency.

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

L1 , L2, L3

Module - 5

Ideal gases: Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air- Water mixtures and related properties.

Real gases – Introduction , Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Beattie-Bridgeman equation , Law of corresponding states, compressibility factor; compressibility chart. Difference between Ideal and real gases.

L1 , L2

Course outcomes:

- Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.
- Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.
- Interpret behavior of pure substances and its applications to practical problems.
- Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases.
- Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-

TEXT BOOKS:

1. Basic Engineering Thermodynamics, A.Venkatesh, Universities Press, 2008
2. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS

1. Thermodynamics, An Engineering Approach, YunusA.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002
2. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. Fundamentals of Classical Thermodynamics, G.J.VanWylen and R.E.Sonntag, Wiley Eastern.
4. An Introduction to Thermodynamcis, Y.V.C.Rao, Wiley Eastern, 1993,
5. B.K Venkanna, Swati B. Wadavadagi "Basic Thermodynamics, PHI, New Delhi, 2010

MECHANICS OF MATERIALS
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME34	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes.**
- ▯ **Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.**
- ▯ **Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads.**
- ▯ **Explain the structural behavior of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion.**
- ▯ **Understand the concept of stability and derive crippling loads for columns.**
- ▯ **Understand the concept of strain energy and compute strain energy for applied loads.**

Module - 1

Stress and Strain: Introduction, Hooke's law, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Generalized Hooke's law, Bulk modulus, Relationship between elastic constants.

Module - 2

Analysis of Stress and Strain: Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions.

Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

Module - 3

Shear Forces and Bending Moments: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.

Stress in Beams: Pure bending, Curvature of a beam, Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, 'I' and 'T' cross sections, Flexure Formula, Bending Stresses.

Module - 4

Torsion: Circular solid and hollow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin walled sections

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.

Module - 5

Strain Energy: Castigliano's theorem I and II, Load deformation diagram, Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion.

Theories of Failure: Maximum Principal stress theory, Maximum shear stress theory.

Course outcomes:

- ☐ Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
- ☐ Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads
- ☐ Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle
- ☐ Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
- ☐ Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples
- ☐ Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL
- ☐ Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory

TEXT BOOKS:

1. James M Gere, Barry J Goodno, Strength of Materials, Indian Edition, Cengage Learning, 2009.
2. R Subramanian, Strength of Materials, Oxford, 2005.

REFERENCE BOOKS

1. S S Rattan, Strength of Materials, Second Edition, McGraw Hill, 2011.
2. Ferdinand Beer and Russell Johnston, Mechanics of materials, Tata McGraw Hill, 2003.

METAL CASTING AND WELDING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 A /45A	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To provide detailed information about the moulding processes.**
- ▯ **To provide knowledge of various casting process in manufacturing.**
- ▯ **To impart knowledge of various joining process used in manufacturing.**
- ▯ **To provide adequate knowledge of quality test methods conducted on welded and casted components.**

Module - 1

INTRODUCTION & BASIC MATERIALS USED IN FOUNDRY

Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.

Introduction to casting process & steps involved. Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.

Sand molding: Types of base sand, requirement of base sand. Binder, Additives definition, need and types

Preparation of sand molds: Molding machines- Jolt type, squeeze type and Sand slinger. Study of important molding process: Green sand, core sand, dry sand, sweep mold, CO2 mold, shell mold, investment mold, plaster mold, cement bonded mold. Cores: Definition, need, types. Method of making cores, concept of gating (top, bottom, parting line, horn gate) and risering (open, blind) Functions and types

Module - 2

MELTING & METAL MOLD CASTING METHODS

Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

Casting using metal molds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes

Module - 3

SOLIDIFICATION & NON FERROUS FOUNDRY PRACTICE

Solidification: Definition, Nucleation, solidification variables, Directional solidification-need and methods. Degasification in liquid metals-Sources of gas, degasification methods.

Fettling and cleaning of castings: Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process

Nonferrous foundry practice: Aluminum castings - Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, dressing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.

Module - 4

WELDING PROCESS

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).

Special type of welding: Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding.

Module - 5

SOLDERING , BRAZING AND METALLURGICAL ASPECTS IN WELDING

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds & Residual stresses, Concept of electrodes, filler rod and fluxes. Welding defects- Detection, causes & remedy.

Soldering, brazing, gas welding: Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

Inspection methods: Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

Course outcomes:

- ☐ Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
- ☐ Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
- ☐ Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
- ☐ Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
- ☐ Explain the Solidification process and Casting of Non-Ferrous Metals.
- ☐ Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
- ☐ Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.
- ☐ Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.

TEXT BOOKS:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House,5th Revised Edition 2009.
2. "Manufacturing & Technology": Foundry Forming and Welding,P.N.Rao, 3rd Ed., Tata McGrawHill, 2003.

REFERENCE BOOKS

1. "Process and Materials of Manufacturing", Roy A Lindberg, 4th Ed.Pearson Edu. 2006.
2. "Manufacturing Technology", SeropeKalpakjian, Steuen. R. Sechmid,Pearson Education Asia, 5th Ed. 2006.
3. "Principles of metal casting", Rechar W. Heine, Carl R. Loper Jr., Philip C. Rosenthal, Tata McGraw Hill Education Private Limited Ed.1976.

MACHINE TOOLS AND OPERATIONS
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 B / 45B	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To introduce students to different machine tools in order to produce components having different shapes and sizes.**
- ▯ **To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.**
- ▯ **To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.**

Module - 1

MACHINE TOOLS

Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaping machine, planing machine, grinding machine **[Simple sketches showing major parts of the machines]**

Module - 2

MACHINING PROCESSES

Introduction, Types of motions in machining, turning and Boring, Shaping, Planing and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.

[Sketches pertaining to relative motions between tool and work piece only]

Module - 3

CUTTING TOOL MATERIALS, GEOMETRY AND SURFACE FINISH

Introduction, desirable Properties and Characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish.

Machining equations for cutting operations: Turning, Shaping, Planing, slab milling, cylindrical grinding and internal grinding, Numerical Problems

Module - 4

MECHANICS OF MACHINING PROCESSES

Introduction, Chip formation, Orthogonal cutting, Merchant's model for orthogonal cutting, Oblique cutting, Mechanics of turning process, Mechanics of drilling process, Mechanics of milling process, Numerical problems.

Module - 5

TOOL WEAR, TOOL LIFE: Introduction, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life, machinability, Numerical problems

ECONOMICS OF MACHINING PROCESSES: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Numerical problems

Course outcomes:

- ▯ **Explain the construction & specification of various machine tools.**
- ▯ **Describe various machining processes pertaining to relative motions between tool & work piece.**
- ▯ **Discuss different cutting tool materials, tool nomenclature & surface finish.**
- ▯ **Apply mechanics of machining process to evaluate machining time.**
- ▯ **Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.**

TEXT BOOKS:

1. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, 2003
2. All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006

REFERENCE BOOKS

1. Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition.
2. Metal cutting principles, Milton C. Shaw, Oxford University Press, Second Edition, 2005.

COMPUTER AIDED MACHINE DRAWING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 A / 46A	CIE Marks	40
Number of Hours/Week	05	SEE Marks	60
Total Number of Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ☐ To acquire the knowledge of CAD software and its features.
- ☐ To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views
- ☐ To familiarize the students with Indian Standardson drawing practices.
- ☐ To impart knowledge of thread forms, fasteners, keys,joints and couplings.
- ☐ To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages.
- ☐ To acquire the knowledge of limits,tolerances and fitspertaining to machine drawings.

PART A

INTRODUCTION TO COMPUTER AIDED SKETCHING

Review of graphic interface of the software. Review of basic sketching commands and navigational commands.

2 Hours

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids), True shape of section.

4 Hours

Orthographic views:Conversion of pictorial views into orthographic projections of simple machine partswith or without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines.

4 Hours

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

8 Hours

PART B

Keys and Joints: Parallel, Taper, Feather Key, Gib head key and Woodruff key

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Joints:Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods.8 Hours

Couplings: Split muff coupling, Protected type flange coupling, Pin (bush) type flexible coupling, Oldham's coupling and Universal coupling (Hook's Joint).

6 Hours

PART C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry. 3 Hours

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Lathe square tool post

15 Hours

Course outcomes:

- ▯ Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
- ▯ Orthographic views of machine parts with and without sectioning in 2D.
- ▯ Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
- ▯ Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
- ▯ Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D
- ▯ single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
- ▯ Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
- ▯ assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal, Published by Charotar Publishing House, 1999.
3. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006.

REFERENCE BOOKS

1. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007.
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

Internal Assessment: 20 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (40 Marks)

- (a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 20Marks.
- (b) Internal Assessment test in the same pattern as that of the main examination: 20 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.

Student has to answer one question each from Part A, Part B for 15 marks each and one question from Part C for 50 marks.

Part A 1 x 25	= 25 Marks
Part B 1 x 25	= 25 Marks
Part C 1 x 50	= <u>50 Marks</u>
Total	= 100 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.

MECHANICAL MEASUREMENTS AND METROLOGY
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 B / 46B	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ **Understand metrology, its advancements & measuring instruments,**
- ▯ **Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.**
- ▯ **Equip with knowledge of limits, fits, tolerances and gauging.**
- ▯ **Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.**
- ▯ **Understand the measurement of Force, Torque, Pressure, Temperature and Strain.**

Module - 1

MACHINE TOOLS

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement.

System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars (Numerical Problems), standardization.

Linear Measurement and angular measurements:

Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112).

Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.

Module - 2

System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators:

Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, , LVDT, Pneumatic- back pressure gauges, Solex comparators and optical comparators- Zeiss ultra-optimizer.

Module - 3**Measurement of screw thread and gear:**

Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.

Advances in metrology:

Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines-constructural features, applications.

Module - 4**Measurement systems and basic concepts of measurement methods:**

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

Module - 5**Force, Torque and Pressure Measurement:**

Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature:

Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors. Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.

Course outcomes:

- ▯ **Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.**
- ▯ **Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.**
- ▯ **Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.**
- ▯ **Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter**
- ▯ **Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.**
- ▯ **Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile**

- **Understand laser interferometers and Coordinate measuring machines.**
- **Explain measurement systems, transducers, intermediate modifying devices and terminating devices.**
- **Describe functioning of force, torque, pressure, strain and temperature measuring devices.**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, Delhi, 2009.

REFERENCE BOOKS

1. **Engineering Metrology and Measurements**, Bentley, Pearson Education.
2. **Theory and Design for Mechanical Measurements, III edition**, Richard S Figliola, Donald E Beasley, WILEY India Publishers.
3. **Engineering Metrology**, Gupta I.C., Dhanpat Rai Publications.
4. **Deoblin's Measurement system**, Ernest Deoblin, Dhaneshmanick, McGraw–Hill.
5. **Engineering Metrology and Measurements**, N.V. Raghavendra and L. Krishnamurthy, Oxford University Press.

MATERIALS TESTING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 A / 47A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. To understand mechanical behavior of various engineering materials by conducting standard tests.
3. To learn material failure modes and the different loads causing failure.
4. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials.
To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel.
Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel.
Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. To study the defects of Cast and Welded components using Non-destructive tests like:
 - a) Ultrasonic flaw detection
 - b) Magnetic crack detection
 - c) Dye penetration testing.

PART B

1. Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
2. Torsion Test on steel bar.
3. Bending Test on steel and wood specimens.
4. Izod and Charpy Tests on Mild steel and C.I Specimen.
5. To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
6. Fatigue Test (demonstration only).

Course outcomes:

- ▯ **Acquire experimentation skills in the field of material testing.**
- ▯ **Develop theoretical understanding of the mechanical properties of materials by performing experiments.**
- ▯ **Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.**
- ▯ **Apply the knowledge of testing methods in related areas.**
- ▯ **Know how to improve structure/behavior of materials for various industrial applications.**

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 B / 47B	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

PART – A : MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART B : METROLOGY

1. Measurement using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer OR
 - b) Drill tool Dynamometer.
5. Measurement of Screw threads Parameters using two wire or Three-wire methods.
6. Measurement of Surface roughness, using Tally Surf/Mechanical Comparator.
7. Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer.
8. Calibration of Micrometer using slip gauges.
9. Measurement using Optical Flats.

Course outcomes:

- ▯ To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer..
- ▯ To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
- ▯ To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats..
- ▯ To measure cutting tool forces using Lathe/Drill tool dynamometer..
- ▯ To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.
- ▯ To measure surface roughness using Tally Surf/ Mechanical Comparator.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

FOUNDRY AND FORGING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38A / 48A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ☐ **To provide an insight into different sand preparation and foundry equipment.**
- ☐ **To provide an insight into different forging tools and equipment.**
- ☐ **To provide training to students to enhance their practical skills.**
- ☐ **To practically demonstrate precautions to be taken during casting and hot working.**
- ☐ **To develop team qualities and ethical principles.**

PART-A

1. Testing of Molding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Sieve Analysis to find Grain Fineness Number(GFN) of Base Sand
4. Clay content determination in Base Sand.

PART-B

2. Foundry Practice

1. Use of foundry tools and other equipment's.
2. Preparation of molding sand mixture.
3. Preparation of green sand molds using two molding boxes kept ready for pouring.
 - ☐ Using patterns (Single piece pattern and Split pattern)
 - ☐ Without patterns.
 - ☐ Incorporating core in the mold. (Core boxes).
 - ☐ Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations :

Use of forging tools and other equipment's

- Calculation of length of the raw material required to prepare the model considering scale losses.
- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Demonstration of forging model using Power Hammer.

Course outcomes:

Students will be able to

- Demonstrate various skills of sand preparation, molding.**
- Demonstrate various skills of forging operations.**
- Work as a team keeping up ethical principles.**

Scheme of Examination:

One question is to be set from Part-A 30 Marks

One question is to be set from either Part-B or Part-C 50 Marks

Viva – Voce 20 Marks

Total 100 Marks

MACHINE SHOP
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38B / 48B	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ▯ **To provide an insight to different machine tools, accessories and attachments**
- ▯ **To train students into machining operations to enrich their practical skills**
- ▯ **To inculcate team qualities and expose students to shop floor activities**
- ▯ **To educate students about ethical , environmental and safety standards**

PART-A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART-B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper
 Cutting of Gear Teeth using Milling Machine

PART C

For demonstration

Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder. Demonstration of surface milling /slot milling

Course outcomes:

- ▯ **Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves etc using shaper**
- ▯ **Perform gear tooth cutting using milling machine**
- ▯ **Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling**
- ▯ **Demonstrate precautions and safety norms followed in Machine Shop**
- ▯ **Exhibit interpersonal skills towards working in a team**

Scheme of Examination:

One Model from Part – A 50 Marks

One Model from Part – B 30 Marks

Viva Voce 20 Marks

Total 100 Marks

KINEMATICS OF MACHINES
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. Familiarize with mechanisms and motion analysis of mechanisms.
2. Understand methods of mechanism motion analysis and their characteristics.
3. Analyse motion of planar mechanisms, gears, gear trains and cams.

Module - 1

Introduction: Definitions: Link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, Classification of pairs based on type of relative motion, Grubler's criterion, mobility of mechanism, Grashoff's criteria, inversions of Grashoff's chain.
Mechanisms: Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling, Straight line motion mechanisms, Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for correct steering, Ackerman steering gear mechanism.

Module - 2

Velocity and Acceleration Analysis of Mechanisms (Graphical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Coriolis's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.
Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method.
Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

Module - 3

Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method.
Freudenstein's equation for four bar mechanism and slider crank mechanism. **Function Generation** for four bar mechanism.

Module - 4

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference.
Gear Trains: Simple gear trains, compound gear trains.
 Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.

Module - 5

Cams: Types of cams, types of followers. displacement, velocity and acceleration curves for uniform velocity, Simple Harmonic Motion, Uniform Acceleration, Retardation and Cycloidal motion.

Cam profiles: disc cam with reciprocating followers such as knife-edge, roller and flat-face followers, inline and offset.

Analysis of Cams: Analysis of arc cam with flat faced follower.

Course outcomes:

1. Identify mechanisms with basic understanding of motion.
2. Comprehend motion analysis of planar mechanisms, gears, gear trains and cams.
3. Carry out motion analysis of planar mechanisms, gears, gear trains and cams.

TEXT BOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009.

REFERENCE BOOKS

- Michael M Stanisc, Mechanisms and Machines-Kinematics, Dynamics and Synthesis, Cengage Learning, 2016.
2. Sadhu Singh, **Theory of Machines**, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006.

APPLIED THERMODYNAMICS
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME43	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To have a working knowledge of basic performance of Gas power cycles.**
- ▯ **To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy**
- ▯ **To understand and evaluate the performance of steam power cycles their various Engineering applications**
- ▯ **To know how fuel burns and their thermodynamic properties.**
- ▯ **To Understand mechanism of power transfer through belt, rope, chain and gear drives in I C Engines**
- ▯ **To determine performance parameters of refrigeration and air-conditioning systems.**
- ▯ **Evaluate the performance parameters of reciprocating air compressor as a function of receiver pressure.**

Module - 1

Gas Power Cycles: Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T-s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles. Jet propulsion: Introduction to the principles of jet propulsion,

Module - 2

Vapour Power Cycles: Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-s diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in Vapour power cycles, Binary Vapour cycles.

Module - 3

Combustion Thermodynamics: Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. Dissociation and equilibrium, emissions.

I.C.Engines: Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels.

Module - 4

Refrigeration Cycles: Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Any one case study on cold storage or industrial refrigerator. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system. Steam jet refrigeration.

Psychrometrics and Air-conditioning Systems: Properties of Atmospheric air, and Psychrometric properties of Air, Psychrometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of two moist air streams. Cooling towers.

Module - 5

Reciprocating Compressors: Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression.

Steam nozzles: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow

Course outcomes:

- **Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.**
- **Evaluate the performance of steam turbine components.**
- **Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment.**
- **Apply thermodynamic concepts to analyze turbo machines.**
- **Determine performance parameters of refrigeration and air-conditioning systems.**
- **Understand the principles and applications of refrigeration systems.**
- **Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air-conditioning system.**
- **Understand the working, applications, relevance of air and identify methods for performance improvement.**

TEXT BOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009. Thermodynamics an engineering approach, by Yunus A. Cengel and Michael A. Boles. Tata McGraw hill Pub. Sixth edition, 2008.
3. Basic and Applied Thermodynamics" by P .K. Nag, Tata McGraw Hill, 2nd Edi. 2009
4. Fundamentals of Thermodynamics by G.J. Van Wylen and R.E. Sonntag, Wiley Eastern. Fourth edition 1993.

REFERENCE BOOKS:

1. Thermodynamics for engineers, Kenneth A. Kroos and Merle C. Potter, Cengage Learning, 2016
2. Principles of Engineering Thermodynamics, Michael J, Moran, Howard N. Shapiro, Wiley, 8th Edition
3. An Introduction to Thermo Dynamics by Y.V.C.Rao, Wiley Eastern Ltd, 2003.
4. Thermodynamics by Radhakrishnan. PHI, 2nd revised edition.
5. I.C Engines by Ganeshan.V. Tata McGraw Hill, 4th Edi. 2012.
6. I.C. Engines by M.L. Mathur & Sharma. Dhanpat Rai & sons- India

FLUID MECHANICS

B.E, IV Semester, Mechanical Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ To have a working knowledge of the basic properties of fluids and understand the continuum approximation
- ▯ To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy
- ▯ To understand the flow characteristic and dynamics of flow field for various Engineering applications
- ▯ To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
- ▯ To discuss the main properties of laminar and turbulent pipe flow and appreciate their differences and the concept of boundary layer theory.
- ▯ Understand the concept of dynamic similarity and how to apply it to experimental modeling
- ▯ To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows

Module - 1

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Concept of continuum, types of fluids etc, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, Absolute, gauge, atmospheric and vacuum pressures pressure measurement by simple, differential manometers and mechanical gauges.

Fluid Statics: Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid. Buoyancy, center of buoyancy, meta center and meta centric height its application in shipping, stability of floating bodies.

Module - 2

Fluid Kinematics and Dynamics:

Fluid Kinematics: Types of Flow-steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates. Rotation, vorticity and circulation, Laplace equation in velocity potential and Poisson equation in stream function, flow net, Problems.

Fluid Dynamics:

Momentum equation, Impacts of jets- force on fixed and moving vanes, flat and curved. Numericals. Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem such as venturi meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc., related numericals.

Module - 3

Laminar and turbulent flow: Reynolds Number, Entrance flow and Developed flow, Navier-Stokes Equation (no derivation), Laminar flow between parallel plates, Poiseuille equation – velocity profile, Couette flow, Fully developed laminar flow in circular pipes, Hagen - Poiseuille

equation, related numericals.

Energy consideration in pipe flow, Loss of Pressure Head due to Fluid Friction, Darcy Weishach formula, major and minor losses in pipes, Commercial pipe, Colebrook equation, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numericals and simple pipe design problems.

Module - 4

Flow over bodies: Development of boundary layer, Prandtl's boundary layer equations, Blasius solution, laminar layer over a flat plate, boundary layer separation and its control.

Basic concept of Lift and Drag, Types of drag, Co-efficient of drag and lift, streamline body and bluff body, flow around circular bodies and airfoils, Lift and drag on airfoil, Numerical problems.

Dimensional analysis: Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Rayleigh's method, Buckingham Pi theorem, Similitude and Model studies. Numerical problems

Module - 5

Compressible Flows: Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.

Introduction to CFD: Necessity, limitations, philosophy behind CFD, and applications.

Course outcomes:

- Identify and calculate the key fluid properties used in the analysis of fluid behavior.
- Understand and apply the principles of pressure, buoyancy and floatation
- Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.
- Understand and apply the principles of fluid kinematics and dynamics.
- Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.
- Understand the basic concept of compressible flow and CFD

TEXT BOOKS:

1. Fluid Mechanics (SI Units), Yunus A. Cengel John M. Cimbala, 3rd Ed., Tata a. McGraw Hill, 2014.
2. Fluid Mechanics, F M White, McGraw Hill Publications Eighth edition. 2016
3. Mechanics of Fluids, Merle C. Potter, Devid C. Wiggerrt, Bassem H. Ramadan, Cengage learning, Fourth editions 2016.

REFERENCE BOOKS

1. Fundamentals of Fluid Mechanics by Munson, Young, Okiishi & Huebsch, John Wiley Publications. 7th edition.
2. Fluid Mechanics, Pijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
3. Fluid Mechanics, John F. Douglas, Janul and M. Gasiosek and John A. Swaffield, Pearson Education Asia, 5th ed., 2006.
4. Introduction to Fluid Mechanics by Fox, McDonald, John Wiley Publications, 8th edition.

MACHINE TOOLS AND OPERATIONS
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 B / 45B	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- To introduce students to different machine tools in order to produce components having different shapes and sizes.
- To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
- To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.

Module - 1

MACHINE TOOLS

Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaping machine, planing machine, grinding machine [Simple sketches showing major parts of the machines]

Module - 2

MACHINING PROCESSES

Introduction, Types of motions in machining, turning and Boring, Shaping, Planing and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.

[Sketches pertaining to relative motions between tool and work piece only]

Module - 3

CUTTING TOOL MATERIALS, GEOMETRY AND SURFACE FINISH

Introduction, desirable Properties and Characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish.

Machining equations for cutting operations: Turning, Shaping, Planing, slab milling, cylindrical grinding and internal grinding, Numerical Problems

Module - 4

MECHANICS OF MACHINING PROCESSES

Introduction, Chip formation, Orthogonal cutting, Merchant's model for orthogonal cutting, Oblique cutting, Mechanics of turning process, Mechanics of drilling process, Mechanics of milling process, Numerical problems.

Module - 5

TOOL WEAR, TOOL LIFE: Introduction, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life, machinability, Numerical problems

ECONOMICS OF MACHINING PROCESSES: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Numerical problems

Course outcomes:

- Explain the construction & specification of various machine tools.

- Describe various machining processes pertaining to relative motions between tool & workpiece.
- Discuss different cutting tool materials, tool nomenclature & surface finish.
- Apply mechanics of machining process to evaluate machining time.
- Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.

TEXT BOOKS:

1. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, 2003
2. All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006

REFERENCE BOOKS

1. Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition.
2. Metal cutting principles, Milton C. Shaw, Oxford University Press, Second Edition, 2005.

COMPUTER AIDED MACHINE DRAWING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 A / 46A	CIE Marks	40
Number of Hours/Week	05	SEE Marks	60
Total Number of Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ To acquire the knowledge of CAD software and its features.
- ▯ To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views
- ▯ To familiarize the students with Indian Standard drawing practices.
- ▯ To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- ▯ To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages.
- ▯ To acquire the knowledge of limits, tolerances and fits pertaining to machine drawings.

PART A

INTRODUCTION TO COMPUTER AIDED SKETCHING

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. 2 Hours

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids), True shape of section. 4 Hours

Orthographic views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines. 4 Hours

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw. 8 Hours

PART B

Keys and Joints: Parallel, Taper, Feather Key, Gib head key and Woodruff key

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods. 8 Hours

Couplings: Split muff coupling, Protected type flange coupling, Pin (bush) type flexible coupling, Oldham's coupling and Universal coupling (Hook's Joint).

6 Hours

PART C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry.

3 Hours

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Lathe square tool post

15 Hours

Course outcomes:

- ▯ Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
- ▯ Orthographic views of machine parts with and without sectioning in 2D.
- ▯ Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
- ▯ Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
- ▯ Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D
- ▯ single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
- ▯ Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
- ▯ assemblies from the part drawings with limits, fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal, Published by Charotar Publishing House, 1999.
3. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006.

REFERENCE BOOKS

1. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007.
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

Internal Assessment: 20 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (40 Marks)

- (a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 20 Marks.
- (b) Internal Assessment test in the same pattern as that of the main examination: 20 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.

Student has to answer one question each from Part A, Part B for 15 marks each and one question from Part C for 50 marks.

Part A 1 x 25 = 25 Marks

Part B 1 x 25 = 25 Marks

Part C 1 x 50 = 50 Marks

Total = 100 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.

MECHANICAL MEASUREMENTS AND METROLOGY
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36B / 46B	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

Credits – 03

Course Objectives:

- Understand metrology, its advancements & measuring instruments,
- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.
- Equip with knowledge of limits, fits, tolerances and gauging.
- Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.
- Understand the measurement of Force, Torque, Pressure, Temperature and Strain.

MODULE 1

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars(Numerical problems), standardization.

Linear Measurement and angular measurements:

Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112).

Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.

MODULE 2

System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances.

Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators:

Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, , LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimizer.

MODULE 3**Measurement of screw thread and gear:**

Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.

Advances in metrology:

Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines- constructional features, applications.

MODULE 4**Measurement systems and basic concepts of measurement methods:**

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

MODULE 5**Force, Torque and Pressure Measurement:**

Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature:

Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors.

Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.

Course outcomes:

- **Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.**
- **Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.**
- **Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.**
- **Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Sorex comparators and Zeiss Ultra Optimeter.**
- **Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.**

- Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile.
- Understand laser interferometers and Coordinate measuring machines.
- Explain measurement systems, transducers, intermediate modifying devices and terminating devices.
- Describe functioning of force, torque, pressure, strain and temperature measuring devices.

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Instrumentation, Measurement and Analysis**, B C Nakra, K K Chaudhry, 4th Edition, McGraw –Hill
3. **Engineering Metrology**, R.K. Jain, Khanna Publishers, Delhi, 2009.

REFERENCE BOOKS

1. **Engineering Metrology and Measurements**, Bentley, Pearson Education.
2. **Theory and Design for Mechanical Measurements, III edition**, Richard S Figliola, Donald E Beasley, WILEY India Publishers.
3. **Engineering Metrology**, Gupta I.C., Dhanpat Rai Publications.
4. **Deoblin's Measurement system**, Ernest Deoblin, Dhanesh manick, McGraw–Hill.
5. **Engineering Metrology and Measurements**, N.V. Raghavendra and L. Krishnamurthy, Oxford University Press.

MATERIALS TESTING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 A / 47A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. To understand mechanical behavior of various engineering materials by conducting standard tests.
3. To learn material failure modes and the different loads causing failure.
4. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials.
To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel.
Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel.
Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. To study the defects of Cast and Welded components using Non-destructive tests like:
 - a) Ultrasonic flaw detection
 - b) Magnetic crack detection
 - c) Dye penetration testing.

PART B

1. Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
2. Torsion Test on steel bar.
3. Bending Test on steel and wood specimens.
4. Izod and Charpy Tests on Mild steel and C.I Specimen.
5. To study the wear characteristics of ferrous and non-ferrous materials under different parameters.

6. Fatigue Test (demonstration only).

Course outcomes:

- ▯ **Acquire experimentation skills in the field of material testing.**
- ▯ **Develop theoretical understanding of the mechanical properties of materials by performing experiments.**
- ▯ **Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.**
- ▯ **Apply the knowledge of testing methods in related areas.**
- ▯ **Know how to improve structure/behavior of materials for various industrial applications.**

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LAB
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37B / 47B	CIE Marks	40
Number of Lecture Hours/Week	03 (1Hour instruction + 2 hours Laboratory)	SEE Marks	60
RBT Levels	L1 , L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

PART A :MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer OR
 - b) Drill tool Dynamometer.
5. Measurements of Screw thread Parameters using two wire or Three-wire methods.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Course outcomes:

- ☐ To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer.
- ☐ To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
- ☐ To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
- ☐ To measure cutting tool forces using Lathe/Drill tool dynamometer.
- ☐ To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.
- ☐ To measure surface roughness using Tally Surf/ Mechanical Comparator.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
<u>Viva -Voice:</u>	<u>20 Marks</u>
Total :	100 Marks

FOUNDRY AND FORGING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38A / 48A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ☐ To provide an insight into different sand preparation and foundry equipment.
- ☐ To provide an insight into different forging tools and equipment.
- ☐ To provide training to students to enhance their practical skills.
- ☐ To practically demonstrate precautions to be taken during casting and hot working.
- ☐ To develop team qualities and ethical principles.

PART-A

1. Testing of Molding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Sieve Analysis to find Grain Fineness Number(GFN) of Base Sand
4. Clay content determination in Base Sand.

PART-B

2. Foundry Practice

1. Use of foundry tools and other equipment's.
2. Preparation of molding sand mixture.
3. Preparation of green sand molds using two molding boxes kept ready for pouring.
 - ☐ Using patterns (Single piece pattern and Split pattern)
 - ☐ Without patterns.
 - ☐ Incorporating core in the mold. (Core boxes).
 - ☐ Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations :

Use of forging tools and other equipment's

- Calculation of length of the raw material required to prepare the model considering scale losses.
- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- ☐ Demonstration of forging model using Power Hammer.

Course outcomes:

Students will be able to

- ▯ **Demonstrate various skills of sand preparation, molding.**
- ▯ **Demonstrate various skills of forging operations.**
- ▯ **Work as a team keeping up ethical principles.**

Scheme of Examination:

One question is to be set from Part-A 30

Marks

One question is to be set from either Part-B or Part-C 50 Marks

Viva – Voce 20

Total Marks 100

MACHINE SHOP
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38B / 48B	CIE Marks	40
Number of Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Hours	50	Exam Hours	03

Credits – 02

Course Objectives:

- ▯ To provide an insight to different machine tools, accessories and attachments
- ▯ To train students into machining operations to enrich their practical skills
- ▯ To inculcate team qualities and expose students to shop floor activities
- ▯ To educate students about ethical , environmental and safety standards

PART-A:

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART-B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper
 Cutting of Gear Teeth using Milling Machine

PART C

For demonstration

Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder. Demonstration of surface milling /slot milling

Course outcomes:

- ▯ Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves etc using shaper
- ▯ Perform gear tooth cutting using milling machine
- ▯ Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling
- ▯ Demonstrate precautions and safety norms followed in Machine Shop
- ▯ Exhibit interpersonal skills towards working in a team

Scheme of Examination:

One Model from Part – A	50 Marks
One Model from Part – B	30 Marks
Viva Voce	20 Marks
Total 100 Marks	

MANAGEMENT AND ENGINEERING ECONOMICS
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- Examine the meaning, importance, nature of management, its difference between management and administration and role of managers in management.
- Examine the meaning characteristics principles and process of organizing.
- Describe effective communication process, its importance, types and purpose for running an organization.
- Explain the importance of engineering economics, Law of demand and supply in engineering decision making.
- Describe various interest rate factors and implement the same for economic decision making.
- Examine different economic analysis methods-NPW, EAW, IRR, FW for decision making.
- Discuss different component of costs and methods of cost estimation.
- Explain depreciation, different methods of computing depreciation.
- Discuss taxation concepts-income tax and corporate taxes.

Module - 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning -steps in planning & planning premises - Hierarchy of plans.

Module - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)

Module - 3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems

Module - 4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems

Module - 5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.

Course outcomes:

On completion of this subject students will be able to

1. Explain the development of management and the role it plays at different levels in an organization.
2. Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
3. Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.
4. Understand engineering economics demand supply and its importance in economics decision making and problem solving.
5. Calculate present worth, annual worth and IRR for different alternatives in economic decision making.
6. Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY
B.E, VSemester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME52	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.
2. Analyze the mechanisms for static and dynamic equilibrium.
3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.
4. Analyze the balancing of rotating and reciprocating masses, governors and gyroscopes.
5. To understand vibrations characteristics of single degree of freedom systems.
6. Characterize the single degree freedom systems subjected to free and forced vibrations with and without damping.

Module - 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

Module - 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

Module - 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

Module - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

Module - 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

Course outcomes:

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

TEXT BOOKS:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K. Grover, Nem Chand and Bros.

REFERENCE BOOKS

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES
B.E, VSemester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME53	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.**
- ▯ **Explain the working principles of turbomachines and apply it to various types of machines**
- ▯ **It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.**

Module - 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process

Module - 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

Module - 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

Module - 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and Propeller turbines** - velocity triangles, design parameters. Problems.

Module - 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

Course outcomes:

- ▯ **Able to give precise definition of turbomachinery**
- ▯ **Identify various types of turbo machinery**
- ▯ **Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines**
- ▯ **Understand the principle of operation of pumps, fans, compressors and turbines.**
- ▯ **Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)**
- ▯ **Analyze the performance of turbo machinery.**

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbo Machines ,B.U.Pai , 1st Editions, Wiley India Pvt, Ltd.
3. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).
3. Text Book of Turbo machines, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module - 1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.
 Static Stresses: Static loads. Normal, Bending, Shear and Combined stresses. Theories of failure. Stress concentration and determination of stress concentration factor.

Module - 2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.
 Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

Module - 3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads. Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

Module - 5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

Course outcomes:

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

TEXT BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME551	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- 1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems**
- 2. Understand the working principles and applications of different types of refrigeration systems**
- 3. Study the working of air conditioning systems and their applications**
- 4. Identify the performance parameters and their relations of an air conditioning system**

Module - 1

Introduction to Refrigeration –Basic Definitions, Heat pump and Refrigerating Machine, Best Refrigeration Cycle:The Carnot Principle, Gas as a Refrigerant in Reversed Carnot Cycle,Limitations of Reversed Carnot Cycle, Reversed Brayton or Bell Coleman Cycle, Application to Aircraft Refrigeration, Simple Numerical problems.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing units.

Module - 2

Vapor Compression Refrigeration System(VCRS): Modifications in Reversed Carnot Cycle with Vapor as a refrigerant, Vapor Compression Cycle, Ewing’s Construction, Actual Vapor Compression Cycle, Effect of Operating Conditions. Simple Numerical problems.

Multistage or Compound Compression, Multi-evaporator systems, Cascade Systems, – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

Module - 3

Vapor Absorption Refrigeration Systems: Simple Vapor – Absorption System, Maximum Coefficient of Performance of a Heat Operated Refrigerating Machine, Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Modifications to Simple Vapor-Absorption, Electrolux Refrigerator.

Other types of Refrigeration systems: (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration,(iii) pulse tube refrigeration, (iv)thermo acoustic refrigeration systems

Module - 4

Refrigerants:Primary and Secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants, Selection of a Refrigerant, Ozone Depletion Potential and Global Warming Potential of CFC Refrigerants. Thermodynamic requirements, Comparison between different refrigerants, Substitutes for CFC refrigerants, Secondary Refrigerants.

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

Module - 5

Air-Conditioning: Basic Processes in Conditioning of Air, Psychrometric Processes in Air-Conditioning Equipment, Simple Air-Conditioning /system and State and Mass Rate of Supply Air, Summer Air Conditioning, Winter Air Conditioning.

Loading Calculation and Applied Psychometrics : Preliminary Considerations, Internal Heat Gains, System Heat Gains, Break-up of Ventilation Load and Effective Sensible Heat Factor, Cooling Load Estimate. Psychrometric Calculations for Cooling, Selection of Air-Conditioning Apparatus for Cooling and Dehumidification, Building Requirements and Energy Conservation in Air Conditioned Buildings.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

Course outcomes:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapor compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapor absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS:

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

NON TRADITIONAL MACHINING
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME554	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8Hours per Module)	Exam Hours	03

Credits – 03

Module - 1

INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

Module - 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

Module - 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

Module - 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

Module - 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

Course outcomes:

- 1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.**
- 2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.**
- 3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.**
- 4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.**
- 5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.**

TEXT BOOKS:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

REFERENCE BOOKS

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME562	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8Hours per Module)	Exam Hours	03

Credits – 03

Course Objective:

- 1. Understand energy scenario, energy sources and their utilization**
- 2. Learn about methods of energy storage, energy management and economic analysis**
- 3. Have proper awareness about environment and eco system.**
- 4. Understand the environment pollution along with social issues and acts.**

Module - 1

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment..

Module - 2

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems
Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing
Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries
Economic Analysis: Scope, Characterization of an Investment Project

Module - 3

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.
Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession.

Module - 4

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies.

Module - 5

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act,

Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

Course outcomes:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S Rao, New Age International, 2006, reprint 2015, 2nd edition.
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

FLUID MECHANICS & MACHINERY LAB
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL57	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART B

1. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines

2. Performance hydraulic Pumps
 - a. Single stage and Multi stage centrifugal pumps
 - b. Reciprocating pump
3. Performance test on a two stage Reciprocating Air Compressor
4. Performance test on an Air Blower

PART C(Optional)

1. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
2. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course outcomes:

- ☐ **Perform experiments to determine the coefficient of discharge of flow measuring devices.**
- ☐ **Conduct experiments on hydraulic turbines and pumps to draw characteristics.**
- ☐ **Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.**
- ☐ **Determine the energy flow pattern through the hydraulic turbines and pumps**
- ☐ **Exhibit his competency towards preventive maintenance of hydraulic machines**
- ☐

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. JagdishLal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 50 Marks
 ONE question from part -B: 30 Marks
 Viva –Voice : 20 Marks
 Total: 100 Marks

ENERGY LAB
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL58	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
Total hours	50	Exam Hours	03

Credits – 02

Course Objectives:

- 1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices**
- 2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.**
- 3. Exhaust emissions of I C Engines will be measured and compared with the standards.**

PART A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART B

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
2. Measurements of Exhaust Emissions of Petrol engine.
3. Measurements of Exhaust Emissions of Diesel engine.

4. Demonstration of p , pV plots using Computerized IC engine test rig

PART C(Optional)

1. Visit to Automobile Industry/service stations.
2. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course outcomes:

- ☐ **Perform experiments to determine the properties of fuels and oils.**
- ☐ **Conduct experiments on engines and draw characteristics.**
- ☐ **Test basic performance parameters of I.C. Engine and implement the knowledge in industry.**
- ☐ **Identify exhaust emission, factors affecting them and report the remedies.**
- ☐ **Determine the energy flow pattern through the I C Engine**
- ☐ **Exhibit his competency towards preventive maintenance of IC engines.**

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) –USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai & sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 50 Marks
ONE question from part -B: 30 Marks
Viva –Voice : 20 Marks
Total: 100 Marks

FINITE ELEMENT ANALYSIS
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME61	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **To learn basic principles of finite element analysis procedure.**
- **To learn the theory and characteristics of finite elements that represent engineering structures.**
- **To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.**

Module - 1

Introduction to Finite Element Method: General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems. Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretization process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

Module - 2

One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for 1D, 2D elements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA8), 2D iso-parametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Force terms: Body force, traction force and point loads,
Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses

Module - 3

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.
Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

Module - 4

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Module - 5

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.
Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

- 1. Understand the concepts behind formulation methods in FEM.**
- 2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.**
- 3. Develop element characteristic equation and generation of global equation.**
- 4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axisymmetric and dynamic problems and solve them displacements, stress and strains induced.**

TEXT BOOKS:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergamon Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

REFERENCE BOOKS

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME62	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.**
- ▯ **To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.**
- ▯ **To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.**
- ▯ **To expose students to computer aided process planning, material requirement planning, capacity planning etc.**
- ▯ **To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.**
- ▯ **To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.**

Module - 1

Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems.

Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems.

Module - 2

CAD and Computer Graphics Software: The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

Module - 3

Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

Line Balancing: Line balancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method.

Module - 4

Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: Material handling, processing and assembly and inspection.

Module - 5

Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing.

Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems.

Course outcomes:

- ☐ Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts.
- ☐ Solve simple problems of transformations of entities on computer screen.
- ☐ Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
- ☐ Analyze the automated flow lines to reduce down time and enhance productivity.
- ☐ Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
- ☐ Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

TEXT BOOKS:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

REFERENCE BOOKS

1. "CAD/CAM" by Ibrahim Zeid, Tata McGraw Hill.
2. "Principles of Computer Integrated Manufacturing", S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.
3. "Work Systems And The Methods, Measurement And Management of Work", Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. "Computer Automation in Manufacturing", Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. "Introduction to Robotics: Mechanics And Control", Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. "**Understanding Additive Manufacturing**", Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME63	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▣ **Study the modes of heat transfer.**
- ▣ **Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.**
- ▣ **Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.**
- ▣ **Study the basic principles of heat exchanger analysis and thermal design.**
- ▣ **Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.**

Module - 1

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.
 Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel.

Module - 2

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications
 Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Numerical Problems, Heisler and Grober charts.
 Introduction to Numerical analysis of Heat conduction

Module - 3

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.
 Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

Module - 4

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield.

Module - 5

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers. Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

Course outcomes:

- ☐ **Understand the basic modes of heat transfer.**
- ☐ **Compute temperature distribution in steady-state and unsteady-state heat conduction**
- ☐ **Understand and interpret heat transfer through extended surfaces.**
- ☐ **Interpret and compute forced and free convective heat transfer.**
- ☐ **Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.**
- ☐ **Design heat exchangers using LMTD and NTU methods.**

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.
3. J P Holman, Souvik Bhattacharyya, 10th Edition, McGraw Hill Education Private Ltd.,

REFERENCE BOOKS

1. Heat and mass transfer, Kurt C, Rolle, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sayma, Bookboon.com

DESIGN OF MACHINE ELEMENTS II
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME64	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▢ To understand various elements involved in a mechanical system.
- ▢ To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
- ▢ To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
- ▢ To design completely a mechanical system integrating machine elements.
- ▢ To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

Module - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.
Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

Module - 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains (Only theoretical treatment)

Springs: Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs, equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

Module - 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

Module - 4

Worm Gears: Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches: Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes: Types of Brakes, Block and Band brakes, self-locking of brakes, and heat generation in brakes.

Module - 5

Lubrication and Bearings: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated. Numerical examples on hydrodynamic journal and thrust bearing design.

Anti-friction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

Course outcomes:

- Apply engineering design tools to product design.
- Design mechanical systems involving springs, belts and pulleys.
- Design different types of gears and simple gear boxes for different applications.
- Design brakes and clutches.
- Design hydrodynamic bearings for different applications.
- Select Anti friction bearings for different applications using the manufacturers, catalogue.
- Develop proficiency to generate production drawings using CAD software.
- Become good design engineers through learning the art of working in a team with morality and ethics.

TEXT BOOKS:

[1] Richard G. Budynas, and J. Keith Nisbett, "Shigley's Mechanical Engineering Design", McGraw-Hill Education, 10th Edition, 2015.

[2] Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, Wiley student edition, 2007.

[3] V. B. Bhandari, "Design of Machine Elements", 4th Ed., Tata Mcgraw Hill, 2016.

REFERENCE BOOKS

References:

- [1] Robert L. Norton “Machine Design- an integrated approach”, Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E “Design and Machine Elements”, Pearson Education, 8th edition,2006.
- [3] Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
- [4] Hall, Holowenko, Laughlin (Schaum’s Outline Series), “Machine design” adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.
- [5] G. M. Maithra and L.V.Prasad, “Hand book of Mechanical Design”, Tata McGraw Hill, 2nd edition,2004

METAL FORMING
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME653	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ **To acquaint with the basic knowledge on fundamentals of metal forming processes**
- ▯ **To study various metal forming processes**
- ▯ **Understanding plastic deformation during forming processes**

Module - 1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties.

Module - 2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metal working, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems.

Module - 3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems.

Module - 4

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems

Module - 5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

Course outcomes:

- ▯ **Able to understand the concept of different metal forming process.**
- ▯ **Able to approach metal forming processes both analytically and numerically**
- ▯ **Able to design metal forming processes**
- ▯ **Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.**

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuvanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K, Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

AUTOMOBILE ENGINEERING
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME655	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ The layout and arrangement of principal parts of an automobile
- ▯ The working of transmission and brake systems
- ▯ The operation and working of steering and suspension systems
- ▯ To know the Injection system and its advancements
- ▯ To know the automobile emissions and its effects on environment

Module - 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system.

Module - 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical

Module - 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system.

Module - 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

Module - 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, controlling crankcase emissions, controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

Course outcomes:

- ☐ To identify the different parts of an automobile and it's working
- ☐ To understand the working of transmission and braking systems
- ☐ To comprehend the working of steering and suspension systems
- ☐ To learn various types of fuels and injection systems
- ☐ To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, SatyaPrakashan,(4th Edition) 1984.

Maintenance Engineering
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME663	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course objectives:

The course is intended to provide basic concepts of maintenance engineering to engineering students with following aspects:

- **To acquire basic understanding of Maintenance systems**
- **To develop an understanding of the principles of Preventive Maintenance & Predictive Maintenance**
- **Provides a methodology for reliability & probability concepts applied to maintenance engineering**
- **The students will concept and procedures for Condition Monitoring in Mechanical and Electrical systems along with the analysis and processing techniques for machine fault identification**

Module – 1

Maintenance systems: Maintenance objectives and scopes; Maintenance strategies & organizations; Maintenance works; life cycle costs Preventive Maintenance: Principles of preventive maintenance, procedures & selection; Preventive Maintenance planning, scheduling and control; Forms & resources; Maintenance work measurement; Modeling and analysis techniques in PM and inspections; Predictive maintenance.

Computerized Maintenance Management systems: Benefits and applications; Work order systems & plant registers; Maintenance reports, analysis and monitoring; Introduction to commercial packages Equipment maintenance: Installation, commissioning and testing of plant equipment, checking for alignment, lubrication and lubrication schedule; maintenance of typical rotating and process equipment systems like turbines, pumps and fans, centrifuges, heat exchangers, boilers and pressure vessels etc.

Module – 2

Reliability & probability Concepts: Basic concepts of probability theory and distributions, definition of reliability, failure probability, reliability and hazard rate function, MTBF and MTTR, System reliability, series and parallel system, redundancy.

Module – 3

Reliability Centered Maintenance: principles of RCM, Benefits of RCM, application of RCM Step-by-step procedure in conducting RCM analysis. The Plant Register. Functions and Failures. Failure mode and effect analysis (FMEA). Failure consequences. Maintenance and decision making. Actuarial analysis and Failure data. Perspective loops. Default action. The RCM Decision diagram. The nature of Failure and Technical history.

Module – 4

Total Productive Maintenance: Goals of TPM and methodology, TPM improvement plan & procedures. The modern role of care and asset management through TPM, the use of TPM concepts consisting of Pareto ABC analysis, Fishbone diagrams, OEE and 5S. Fault analysis.

Condition Monitoring:**Measurable phenomena from different Plant Items:**

Measurable phenomena associated with degradation from a range of plant items including motors/generators, transformers, cables, bushings, connectors, capacitors and circuit breakers.

Module - 5**Fault diagnosis of Rotational Machines:**

Unbalance, shaft and coupling misalignments, bent shafts, gear and bearing wear, oil whirls and shaft eccentricity.

Measurement Strategies and Techniques:

A wide range of strategies and associated technologies will be discussed including light emission (photo multipliers, fiber optic techniques etc.), heat emissions (IR, cameras, direct temperature measurement, etc.), electrical charges (tan d, electrical particle discharge, etc.), force, power and vibration.

Data Processing and Analysis:

For each of the approaches, options with respect to data processing and analysis will be discussed including digital signal processing and computational techniques. Close attention will be paid through examples of the cost benefits and the reliability which can be placed on data with respect to formulating a view on the condition of a give item of plant.

Course outcomes:**On completion of this subject students will be able to:**

1. Understand maintenance objectives and evaluate various maintenance strategies for process plant application, Develop necessary planning and scheduling and control of preventive maintenance activities.
2. Evaluate reliability of a simple plant component and system.
3. Understand and apply the advanced concepts such as RCM and advantages for a company employing them
4. Understand and apply the advanced concepts such as TPM and advantages for a company employing
5. Apply the principles of condition monitoring systems.
6. Apply the mechanical condition monitoring techniques and analyze the data used in condition monitoring

TEXT BOOKS:

1. Practical machinery Vibration Analysis & Predictive Maintenance, C. Scheffer and P. Girdhar,, IDC technologies, 2004.
2. Introduction to Machinery Analysis and Monitoring, John S. Mitchell, PennWell Books, 1993.
3. Machinery Vibration, Measurement and Analysis, Victor Wowk, Mc Craw Hill, 1991

REFERENCE BOOKS

1. Handbook of Condition Monitoring, B.K.N. Rao, 1996
2. Reliability Engineering, Srinath L S,
3. Maintenance Replacement and Reliability, Jardine AKS,
4. Practical reliability engineering, Oconnor, Patrick D T
5. , Reliability and Maintainability Engineering, Charles E Ebeling
6. Introduction to Reliability Engineering Lewis E,

TOTAL QUALITY MANAGEMENT
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME664	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course objectives:

- 1. Understand various approaches to TQM**
- 2. Understand the characteristics of quality leader and his role.**
- 3. Develop feedback and suggestion systems for quality management.**
- 4. Enhance the knowledge in Tools and Techniques of quality management**

Module – 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements

Module – 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

Module – 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

Module – 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control: Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

Course outcomes:

- 1. Explain the various approaches of TQM**
- 2. Infer the customer perception of quality**
- 3. Analyze customer needs and perceptions to design feedback systems.**
- 4. Apply statistical tools for continuous improvement of systems**
- 5. Apply the tools and technique for effective implementation of TQM.**

TEXT BOOKS:

- Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS

1. Managing for Quality and Performance Excellence by James R.Evans and William M Lindsay, 9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Heat Transfer Lab
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL67	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course objectives:

- ▯ **The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.**
- ▯ **This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.**

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Stefan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.

7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course outcomes:

1. Perform experiments to determine the thermal conductivity of a metal rod
2. Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
3. Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
4. Determine surface emissivity of a test plate
5. Estimate performance of a refrigerator and effectiveness of fin
6. Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 50 Marks

ONE question from part -B: 30 Marks

Viva –Voice :20 Marks

Total: 100 Marks

Modeling and Analysis Lab (FEA)
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL68	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course objectives:

- ▯ **To acquire basic understanding of Modeling and Analysis software**
- ▯ **To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.**
- ▯ **To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.**

PART – A

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load, UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART – B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination
 - b) Bar subjected to forcing function
 - c) Fixed – fixed beam subjected to forcing function

PART – C

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course outcomes:

- ▯ **Demonstrate the basic features of an analysis package.**
- ▯ **Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.**
- ▯ **Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.**
- ▯ **Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.**
- ▯ **Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.**

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 40Marks (10 Write up +30)

One Question from Part B - 40 Marks (10 Write up +30)

Viva-Voce - 20 Marks

Total 100 Marks

ENERGY ENGINEERING
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME71	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **Understand energy scenario, energy sources and their utilization**
- **Learn about energy conversion methods and their analysis**
- **Study the principles of renewable energy conversion systems**
- **Understand the concept of green energy and zero energy.**

Module - 1

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

Module - 2

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.
Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

Module - 3

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

Module - 4

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal land vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, Limitations.

Module - 5

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts .

Course outcomes:

1. Summarize the basic concepts of thermal energy systems,
2. Identify renewable energy sources and their utilization.
3. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
4. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

FLUID POWER SYSTEMS
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME72	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **To provide an insight into the capabilities of hydraulic and pneumatic fluid power.**
- **To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.**
- **To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.**
- **Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.**
- **To familiarize with logic controls and troubleshooting**

Module - 1

Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

Module - 2

Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

Module - 3

Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design: Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application, hydraulic cylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for

force multiplication; speed control of hydraulic cylinder- metering in, metering out and bleed off circuits. Pilot pressure operated circuits. Hydraulic circuit examples with accumulator.

Module - 4

Pneumatic power systems

Introduction to Pneumatic systems: Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications.

Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

Module - 5

Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

Course outcomes:

1. **Identify and analyse the functional requirements of a fluid power transmission system for a given application.**
2. **Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.**
3. **Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.**
4. **Select and size the different components of the circuit.**
5. **Develop a comprehensive circuit diagram by integrating the components selected for the given application.**

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw Hill, 2002.
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol II, I and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

CONTROL ENGINEERING

B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME73	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- Modeling of mechanical, hydraulic, pneumatic and electrical systems.
- Representation of system elements by blocks and its reduction
- Transient and steady state response analysis of a system.
- Frequency response analysis using polar plot.
- Frequency response analysis using bode plot.
- Analysis of system using root locus plots.
- Different system compensators and variable characteristics of linear systems.

Module - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

Module - 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

Module - 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation

Module - 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins

Module - 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

Course outcomes:

1. **Recognize control system and its types , control actions**
2. **Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, ElectroMechanical)**
3. **Calculate the gain of the system using block diagram and signal flow graph**
4. **Illustrate the response of 1st and 2nd order systems**
5. **Determine the stability of transfer functions in complex domain and frequency domain**
6. **Employ state equations to study the controllability and observability**

TEXT BOOKS:

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. “Control systems Principles and Design”, M.Gopal, 3rd Edition, TMH, 2000.

REFERENCE BOOKS:

3. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
4. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
5. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Ninth edition
6. J.Nagrath and M.Gopal,” Control System Engineering”, New Age International Publishers, 5th Edition, 2007
7. “Feedback control systems”, Schaum’s series, 2001.
8. System dynamics and control, Eronini-Umez, Thomas Asia Pte Ltd., Singapore 2002.

TRIBOLOGY
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME742	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

Credits –03

Course Objectives:

- **To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.**
- **To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.**
- **To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.**
- **To expose the students to the factors influencing the selection of bearing materials for different sliding applications.**
- **To introduce the concepts of surface engineering and its importance in tribology.**

Module - 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

Module - 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

Module - 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

Module - 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

Module - 5

Bearing Materials: Commonly used bearing materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapour phase processes.

Selection of coating for wear and corrosion resistance.

Course outcomes:

1. Understand the fundamentals of tribology and associated parameters.
2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
3. Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
4. Select proper bearing materials and lubricants for a given tribological application.
5. Apply the principles of surface engineering for different applications of tribology.

TEXT BOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCE BOOKS

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME753	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits –03

Course Objective:

- Understand the evolution and development of Mechatronics as a discipline.
- Substantiate the need for interdisciplinary study in technology education.
- Understand the applications of microprocessors in various systems and to know the functions of each element
- Demonstrate the integration philosophy in view of Mechatronics technology

Module - 1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors.

Module - 2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor.

Module - 3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot.

Module - 4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors.

Module - 5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve, solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

Course outcomes:

On completion of this subject, students will be able to:

- 1. Illustrate various components of Mechatronics systems.**
- 2. Assess various control systems used in automation.**
- 3. Develop mechanical, hydraulic, pneumatic and electrical control systems.**

TEXT BOOKS:

1. Nitaigour Premchand Mahalik, Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1st Edition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W. Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1st Edition, 2005 ISBN.No. 81-7758-284-4.

REFERENCE BOOKS

1. Mechatronics by HMT Ltd. – Tata McGraw Hill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power, Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

DESIGN LABORATORY
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL76	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits –02

Course Objective:

- To understand the natural frequency, logarithmic decrement, damping ratio and damping.
- To understand the balancing of rotating masses.
- To understand the concept of the critical speed of a rotating shaft.
- To understand the concept of stress concentration using Photo elasticity.
- To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

Course outcomes:

On completion of this subject, students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.

5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

REFERENCE BOOKS

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

Scheme of Examination:

One question from Part A:	50 Marks
One question from part B:	30 Marks
Viva- Voce:	20Marks
<hr/> Total: <hr/>	<hr/> 100 Marks <hr/>

COMPUTER INTEGRATED MANUFACTURING LAB B.E, VII Semester, Mechanical Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17MEL77	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
Total Hours	40	Exam Hours	03
Credits –02			

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes
CLO2	To educate the students on the usage of CAM packages and cut part on virtual CNC machine simulator.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master-CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Enter program, take tool offsets, cut part in single block and auto mode, measure the virtual part on screen in the virtual CNC machine simulator, for standard CNC control systems FANUC, FAGOR, HAAS and SINUMERIK.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time; set up and cut part on.
CLO6	Understand & write programs for Robot control; understand the operating principles of hydraulics, pneumatics and electro pneumatic systems.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	17MEP78	2	0-3-0	100	-	-

OPERATIONS RESEARCH
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME81	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

Module - 1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. SolutionstoLPP by graphical method(Two Variables).

Module - 2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

Module - 3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution(MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Module - 4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashingofnetworks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models.

Module - 5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method.

Course outcomes:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD. Publications, New Delhi –2007
2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
3. Introduction to Operations Research, Lieberman/Nag/Basu, 9th Edition, McGraw Hill Education Pvt.Ltd.,

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill

ADDITIVE MANUFACTURING
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME82	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- 1. Understand the additive manufacturing process, polymerization and powder metallurgy process**
- 2. Understand characterisation techniques in additive manufacturing.**
- 3. Acquire knowledge on CNC and Automation.**

Module - 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries.

Module - 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, and Triacs. Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

Module - 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] **Polymer Processing:** Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques

General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM

Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.

Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization

Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques.

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.

Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components

Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.

Module - 4

NANO MATERIALS & CHARACTERIZATION TECHNIQUES:

Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology

Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC).

Optical Microscopy - principles, Imaging Modes, Applications, Limitations.

Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. **Transmission Electron Microscopy (TEM)** - principles, Imaging Modes, Applications, Limitations. **X- Ray Diffraction (XRD)** - principles, Imaging Modes, Applications, Limitations. **Scanning Probe Microscopy (SPM)** - principles, Imaging Modes, Applications, Limitations. **Atomic Force Microscopy (AFM)** - basic principles, instrumentation, operational modes, Applications, Limitations. **Electron Probe Micro Analyzer (EPMA)** - Introduction, Sample preparation, Working procedure, Applications, Limitations.

Module - 5

MANUFACTURING CONTROL AND AUTOMATION

CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC **Part programming:** CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)

Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity

Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.

Course outcomes:

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programming and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Interscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME832	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- 4. To understand the measurement of strain using electrical strain gauges.**
- 5. To analyze stress and strains induced mechanical systems using electrical strain gauges.**
- 6. To understand the photo elastic techniques to characterize the elastic behavior of solids.**
- 7. To understand elastic behavior of solid bodies using coating techniques.**
- 8. To apply the holography methods to measure stress and strains.**

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. General consideration in data analysis.

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

Module - 2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

Module - 3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials.

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity.

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's Stress separation techniques: Oblique incidence.

Module - 5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings and its applications.

Moire Methods: Moire fringes produced by mechanical interference. Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements. Applications and advantages

Course outcomes:

1. **Explain and the elastic behavior of solid bodies.**
2. **Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.**
3. **Understand the experimental methods of determining stresses and strains induced.**
4. **Apply the coating techniques to determine the stresses and strains.**

TEXT BOOKS:

1. **"Experimental Stress Analysis"**, Dally and Riley, McGraw Hill.
2. **"Experimental Stress Analysis"**. Sadhu Singh, Khanna publisher.

REFERENCE BOOKS

1. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.
2. **"Photoelasticity Vol I and Vol II**, M.M.Frocht, John Wiley & sons.
3. **"Photo Elastic Stress Analysis"**, Kuske, Albrecht & Robertson John Wiley & Sons.
4. **Motion Measurement and Stress Analysis Dave and Adams**
5. **Holman, "Experimental Methods for Engineers"** Tata McGraw Hill Companies, 7th Edition, New York, 2007

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	17ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	17MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	17MES86	1	0-4-0	100	-	-

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME51	Management and Engineering Economics	3	2	0	03	80	20	100	4
2	15ME52	Dynamics of Machinery	3	2	0	03	80	20	100	4
3	15ME53	Turbo Machines	3	2	0	03	80	20	100	4
4	15ME54	Design of Machine Elements - I	3	2	0	03	80	20	100	4
5	15ME55X	Professional Elective-I	3	0	0	03	80	20	100	3
6	15ME56X	Open Elective-I	3	0	0	03	80	20	100	3
7	15MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	80	20	100	2
8	15MEL58	Energy Lab	1	0	2	03	80	20	100	2
TOTAL			21	06	04		640	160	800	26

Professional Elective-I		Open Elective-I	
15ME551	Refrigeration and Air-conditioning	15ME562	Energy and Environment
15ME554	Non Traditional Machining		

1. **Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
2. **Professional Elective:** Elective relevant to chosen specialization/ branch
3. **OpenElective:** Electives from other technical and/or emerging subject areas.

MANAGEMENT AND ENGINEERING ECONOMICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Management And Engineering Economics	15ME51	04	3-2-0	80	20	3Hrs

MODULE – 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought- early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans. **10 Hours**

MODULE - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief) **10 Hours**

MODULE -3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity.

Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems **10 Hours**

MODULE -4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems **10 Hours**

MODULE -5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems. **10 Hours**

Course outcomes

On completion of this subject students will be able to

1. Understand needs, functions, roles, scope and evolution of Management
2. Understand importance, purpose of Planning and hierarchy of planning and also analyze its types
3. Discuss Decision making, Organizing, Staffing, Directing and Controlling
4. Select the best economic model from various available alternatives
5. Understand various interest rate methods and implement the suitable one.
6. Estimate various depreciation values of commodities
7. Prepare the project reports effectively.

TEXT BOOKS

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Dynamics of Machinery	15ME52	04	3-2-0	80	20	3Hrs

Course Objectives

1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.
2. Analyse the mechanisms for static and dynamic equilibrium.
3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.
4. Analyse the balancing of rotating and reciprocating masses, governors and gyroscopes.
5. To understand vibrations characteristics of single degree of freedom systems.
6. Characterise the single degree freedom systems subjected to free and forced vibrations with and without damping.

MODULE 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

10 Hours

MODULE 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

10 Hours

MODULE 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

10 Hours

MODULE - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

10 Hours

MODULE – 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

10 Hours

Course outcomes

On completing the course the student will be able to

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

Text Books:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K. Grover, Nem Chand and Bros.

Reference Books:

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Turbo Machines	15ME53	04	3-2-0	80	20	3Hrs

Course Objectives:

- The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.
- Explain the working principles of turbomachines and apply it to various types of machines
- It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.

Module 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process **(10 Hours)**

Module 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

(10 Hours)

Module 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

(10 Hours)

Module 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and**

Propeller turbines - velocity triangles, design parameters. Problems. **(10 Hours)**

Module 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

(10 Hours)

Course Outcomes:

- Able to give precise definition of turbomachinery
- Identify various types of turbo machinery
- Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
- Understand the principle of operation of pumps, fans, compressors and turbines.
- Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)
- Analyze the performance of turbo machinery.

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).

3. Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements	15ME54	04	3-2-0	80	20	3Hrs

Course Objectives

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module-1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.

Static Stresses: Static loads .Normal, Bending, Shear and Combined stresses. Stress concentration and determination of stress concentration factor.

10 Hours

Module -2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.

Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

10Hours

Module -3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads.

Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

10 Hours

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

10 Hours

Module -5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

10 Hours

Course outcomes

On completion of the course the student will be able to

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

Text Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

Reference Books:

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
(Professional Elective-I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Refrigeration And Air-Conditioning	15ME551	03	3-0-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course objectives

1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems
2. Understand the working principles and applications of different types of refrigeration systems
3. Study the working of air conditioning systems and their applications
4. Identify the performance parameters and their relations of an air conditioning system

Module – I

Introduction to Refrigeration –Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications:Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing and food chain, Miscellaneous
8 Hours

Module – II

Vapour Compression Refrigeration System(VCRS): Comparison of Vapour Compression Cycle and Gas cycle,Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency,Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP – Ewing’s construction and Gosney’s method.Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure,Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

10 Hours

Module – III

Vapour Absorption Refrigeration Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.Practical problems – crystallization and air leakage, Commercial systems

Other types of Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermo acoustic refrigeration systems

8

Hours

Module – IV

Refrigerants:Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

8 Hours

Module – V

Air-Conditioning: Introduction to Air-Conditioning, Basic Definition, Classification, power rating, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapour compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

Data Book:

1. Shan K. Wang, Handbook of Air Conditioning and Refrigeration, 2/e, 2001 McGraw-Hill Education
2. Mathur M.L. & Mehta, Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, F.S., Jain Brothers, 2008

E- Learning

- VTU, E- learning, MOOCS, Open courseware

**NON TRADITIONAL MACHINING
(Professional Elective-I)**

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Non Traditional Machining	15ME554	03	3-0-0	80	20	3Hrs

MODULE 1

INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

08 hours

MODULE 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

08 hours

MODULE 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process.

Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

10 hours

MODULE 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

08 hours

MODULE 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

08 hours

Course Outcomes

On completion of the course, the students will be able to

1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.
2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

Text Books:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

Reference Books

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
(OPEN ELECTIVE – I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy And Environment	15ME562	03	3-0-0	80	20	3Hrs

Course Objectives

1. Understand energy scenario, energy sources and their utilization
2. Learn about methods of energy storage, energy management and economic analysis
3. Have proper awareness about environment and eco system.
4. Understand the environment pollution along with social issues and acts.

Module – I

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment. **8 Hours**

Module – II

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems

Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing

Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries

Economic Analysis: Scope, Characterization of an Investment Project

10 Hours

Module – III

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.

Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. **8 Hours**

Module – IV

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies. **8 Hours**

Module – V

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS:

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S rao, New Age Inytermnational, 2006, reprint 2015, 2nd edition
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

E- Learning

- India Energy Outlook 2015(www.iea.org/.../IndiaEnergyOutlook_WEO2015.pdf)
- Open courseware

FLUID MECHANICS & MACHINERY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Mechanics & Machinery Lab	15MEL57	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Turbo Machines

Prerequisites : Fluid Mechanics and Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART – B

7. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
8. Performance hydraulic Pumps
 - d. Single stage and Multi stage centrifugal pumps
 - e. Reciprocating pump
9. Performance test on a two stage Reciprocating Air Compressor
10. Performance test on an Air Blower

PART – C (Optional)

11. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
12. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course Outcomes:

At the end of this course students are able to,

1. Perform experiments to determine the coefficient of discharge of flow measuring devices.
2. Conduct experiments on hydraulic turbines and pumps to draw characteristics.
3. Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
4. Determine the energy flow pattern through the hydraulic turbines and pumps
5. Exhibit his competency towards preventive maintenance of hydraulic machines

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

ENERGY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Lab	15MEL58	02	1-0-2	80	20	3Hrs

Prerequisites: Basic and Applied Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
3. Exhaust emissions of I C Engines will be measured and compared with the standards.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART - B

7. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
8. Measurements of Exhaust Emissions of Petrol engine.
9. Measurements of Exhaust Emissions of Diesel engine.
10. Measurement of $p\theta$, pV plots using Computerized IC engine test rig

PART – C (Optional)

11. Visit to Automobile Industry/service stations.
12. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course Outcomes: At the end of this course students are able to,

1. Perform experiments to determine the properties of fuels and oils.
2. Conduct experiments on engines and draw characteristics.
3. Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
4. Identify exhaust emission, factors affecting them and report the remedies.
5. Determine the energy flow pattern through the I C Engine
6. Exhibit his competency towards preventive maintenance of IC engines.

References

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) – USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai& sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME61	Finite Element Analysis	3	2	0	03	80	20	100	4
2	15ME62	Computer integrated Manufacturing	4	0	0	03	80	20	100	4
3	15ME63	Heat Transfer	3	2	0	03	80	20	100	4
4	15ME64	Design of Machine Elements -II	3	2	0	03	80	20	100	4
5	15ME65X	Professional Elective-II	3	0	0	03	80	20	100	3
6	15ME66X	Open Elective-II	3	0	0	03	80	20	100	3
7	15MEL67	Heat Transfer Lab	1	0	2	03	80	20	100	2
8	15MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	80	20	100	2
TOTAL			21	6	04		640	160	800	26

Professional Elective-II		Open Elective-II	
15ME653	Metal Forming	15ME664	Total Quality Management
15ME655	Automobile Engineering		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

FINITE ELEMENT ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Finite Element Analysis	15ME61	04	3-2-0	80	20	3Hrs

Course Objectives:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Module I

Introduction to Finite Element Method :General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems.Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

10 Hours

Module II

One-Dimensional Elements-Analysis of Bars and Trusses,

Linear interpolation polynomials in terms of localcoordinate's for1D, 2Delements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, , , Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA

8), 2D isoparametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Fore terms: Body force, traction force and point loads,

Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses.

10 Hours

Module III

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.

Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

08 Hours

Module IV

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic net works.

10 Hours

Module V

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.

Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind formulation methods in FEM.
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
3. Develop element characteristic equation and generation of global equation.
4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

12Hours

Text Books:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergaman Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

Reference Books:

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing	15ME62	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
CLO2	To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
CLO3	To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
CLO4	To expose students to computer aided process planning, material requirement planning, capacity planning etc.
CLO5	To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
CLO6	To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module - 1

1. Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems. **5 Hours**

2. Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems. **5 Hours**

Module – 2

3. CAD and Computer Graphics Software:The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

5 Hours

4. Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

5 Hours

Module- 3

5. Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

5 Hours

6. Line Balancing: Linebalancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line balancing, computerized line balancing methods.

5 Hours

Module-4.

7. Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

5 Hours

8. Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: material handling, processing and assembly and inspection.

5 Hours

Module – 5

9. Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing. **5 Hours**

10. Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems. **5 Hours**

Course Outcomes:

After studying this course, students will be able to:

CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen.
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
CO3	Analyze the automated flow lines to reduce down time and enhance productivity.
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Text Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

Reference Books:

1. “CAD/CAM” by Ibrahim Zeid, Tata McGraw Hill.
2. “Principles of Computer Integrated Manufacturing”, S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.

3. “Work Systems And The Methods, Measurement And Management of Work”, Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. “Computer Automation in Manufacturing”, Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. “Introduction to Robotics: Mechanics And Control”, Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. “**Understanding Additive Manufacturing**”, Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer	15ME63	04	3-2-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course learning objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module – I

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel. **8 Hours**

Module – II

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts. **9 Hours**

Module – III

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction, one dimensional unsteady conduction, two-dimensional steady and unsteady conduction, the difference equation, boundary conditions, solution methods, cylindrical coordinates and irregular boundaries.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield. **9 Hours**

Module – IV

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

8 Hours

Module – V

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers.

Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

9 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Understand the basic modes of heat transfer.
- Compute temperature distribution in steady-state and unsteady-state heat conduction
- Understand and interpret heat transfer through extended surfaces.
- Interpret and compute forced and free convective heat transfer.
- Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
- Design heat exchangers using LMTD and NTU methods.

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.

REFERENCE BOOKS:

1. Heat and mass transfer, Kurt C. Rolfe, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sagma, Bookboon.com

MOOCs:

1. Fluid flow, Heat and Mass Transfer- <http://ocw.tudelft.nl/courses/applied-earth-sciences/fluid-flow-heat-mass-transfer/course>
2. Heat transfer course- <https://legacy.saylor.org/me204/Intro/>

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN OF MACHINE ELEMENTS II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements II	15ME64	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To understand various elements involved in a mechanical system.
CLO2	To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
CLO3	To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
CLO4	To design completely a mechanical system integrating machine elements.
CLO5	To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

MODULE I

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

08 Hours

MODULE 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains. (Only theoretical treatment)

Springs:Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs;springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs,equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

10 Hours

MODULE 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

12 Hours

MODULE 4

Worm Gears:Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches:Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes:Types of Brakes, Block and Band brakes,selflocking of brakes, and heat generation in brakes.

10 Hours

MODULE 5

Lubrication and Bearings:Lubricants and their properties, bearing materials and properties;mechanisms of lubrication,hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.

Numerical examples on hydrodynamic journal and thrust bearing design.

Anti friction bearings:Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

10 Hours

Course Outcomes:

After learning the course the students should be able to:

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs, belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers, catalogue.
C07	Develop proficiency to generate production drawings using CAD software.
C08	Become good design engineers through learning the art of working in a team with morality and ethics.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, single plate clutch, etc.) A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit (5 marks) in internal assessment.

Textbooks:

- [1] Richard G. Budynas, and J. Keith Nisbett, "Shigley's Mechanical Engineering Design", McGraw-Hill Education, 10th Edition, 2015.
- [2] Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, Wiley student edition, 2007.
- [3] V. B. Bhandari, "Design of Machine Elements", 4th Ed., Tata Mcgraw Hill, 2016.

References:

- [1] Robert L. Norton "Machine Design- an integrated approach", Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E "Design and Machine Elements", Pearson Education, 8th edition, 2006.
- [3] Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.

[4] Hall, Holowenko, Laughlin (Schaum's Outline Series), "Machine design" adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.

[5] G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill, 2nd edition,2004.

Design Data Hand Book:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010

[4]PSG Design Data Hand Book, PSG College of technology, Coimbatore.

METAL FORMING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Metal Forming	15ME653	3	3-0-0	80	20	3Hrs

Course objectives:

The course is intended to provide basic understanding of Metal Forming with following aspects:

- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes
- Understanding plastic deformation during forming processes

MODULE -1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties. **10 Hrs**

MODULE -2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems. **10 Hrs**

MODULE -3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems. **10 Hrs**

MODULE -4

Extrusion:Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems. **10 Hrs**

MODULE -5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations. **10 Hrs**

Course outcomes:

On completion of this subject, students will be:

2. Able to understand the concept of different metal forming process.
3. Able to approach metal forming processes both analytically and numerically
4. Able to design metal forming processes
5. Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuwanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS:

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K , Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

AUTOMOBILE ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam duration
				SEE	CIA	
Automobile	15ME655	3	3-0-0	80	20	3 Hrs

Course learning objectives: The student will be able to learn

- The layout and arrangement of principal parts of an automobile
- The working of transmission and brake systems
- The operation and working of steering and suspension systems
- To know the Injection system and its advancements
- To know the automobile emissions and its effects on environment

MODULE 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system. **10 Hours**

MODULE 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical **08 Hours**

MODULE 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system. **08 Hours**

MODULE 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

08 Hours

MODULE 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

08 Hours

Course Outcomes: Student will be able

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, Satya Prakashan,(4th Edition) 1984.

TOTAL QUALITY MANAGEMENT

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Total Quality Management	15ME664	03	3-0-0	80	20	3Hrs

COURSE LEARNING OBJECTIVES:

This course enables students to

1. Understand various approaches to TQM
2. Understand the characteristics of quality leader and his role.
3. Develop feedback and suggestion systems for quality management.
4. Enhance the knowledge in Tools and Techniques of quality management

Module - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

08 Hours

Module - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

08 Hours

Module - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

08 Hours

Module - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, and qualityfunction deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

08 Hours

COURSE OUTCOMES:

Student will be able to

1. Explain the various approaches of TQM
2. Infer the customer perception of quality
3. Analyze customer needs and perceptions to design feedback systems.
4. Apply statistical tools for continuous improvement of systems
5. Apply the tools and technique for effective implementation of TQM.

TEXT BOOKS:

1. Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. Managing for Quality and Performance Excellence by James R.Evans and Williuam M Lindsay,9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, ShojiShiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Reference Books:

1. Engineering Optimization Methods and Applications, A Ravindran, K, M.Ragsdell, Willey India Private Limited,2nd Edition,2006.
2. : Introduction to Operations Research- Concepts and Cases, F.S. Hillier. G.J. Lieberman, 9th Edition, Tata McGraw Hill. 2010.

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Heat Transfer Lab

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer Lab	15MEL67	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Heat Transfer

Course Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Steffan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.
7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course Outcomes: At the end of this course students are able to,

- Perform experiments to determine the thermal conductivity of a metal rod

- Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
- Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
- Determine surface emissivity of a test plate
- Estimate performance of a refrigerator and effectiveness of fin
- Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

Modeling and Analysis Lab (FEA)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Modeling and Analysis Lab	15MEL68	02	1-0-2	80	20	3Hrs

CREDITS – 02

Prerequisites: Knowledge of any Modeling software, knowledge of coordinate systems and Geometric transformations etc.

Course objectives:

The course is intended to provide basic understanding of Modeling and Analysis techniques students with following aspects:

- To acquire basic understanding of Modeling and Analysis software
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

PART – A

Study of a FEA package and modeling and stress analysis of:

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load , UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART - B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination

- b) Bar subjected to forcing function
- c) Fixed – fixed beam subjected to forcing function

PART – C (only for demo and oral exam)

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course Outcomes: At the end of the course the students are able to:

- Demonstrate the basic features of an analysis package.
- Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.
- Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
- Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
- Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 32 Marks (08 Write up +24)

One Question from Part B - 32 Marks (08 Write up +24)

Viva-Voce - 16 Marks

Total 80 Marks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME71	Energy Engineering	3	2	0	03	80	20	100	4
2	15ME72	Fluid Power Systems	4	0	0	03	80	20	100	4
3	15ME73	Control Engineering	3	2	0	03	80	20	100	4
4	15ME74X	Professional Elective - III	3	0	0	03	80	20	100	3
5	15ME75X	Professional Elective-IV	3	0	0	03	80	20	100	3
6	15MEL76	Design Lab	1	0	2	03	80	20	100	2
7	15MEL77	CIM Lab	1	0	2	03	80	20	100	2
8	15MEP78	Project Phase – I	-	-	-	-	-	100	100	2
TOTAL			18	4	04		560	240	800	24

Professional Elective-III		Professional Elective-IV	
15ME742	Tribology	15ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

ENERGY ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Engineering	15ME71	04	3-2-0	80	20	3Hrs

Course learning objectives is to

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods and their analysis
- Study the principles of renewable energy conversion systems
- Understand the concept of green energy and zero energy.

Module – I

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

9 Hours

Module – II

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

7 Hours

Module – III

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

8 Hours

Module – IV

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

8 Hours

Module – V

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Summarize the basic concepts of thermal energy systems,
- Identify renewable energy sources and their utilization.
- Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
- Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
- Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
- Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS:

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

Scheme of Examination: Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

FLUID POWER SYSTEMS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Power Systems	15ME72	04	3-2-0	80	20	3Hrs

Course objectives:

CLO1	To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
CLO2	To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
CLO3	To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
CLO4	Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
CLO5	To familiarize with logic controls and trouble shooting

Module 1: Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

10 hours

Module 2: Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

10 hours

Module 3: Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design:Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application,hydrauliccylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for force multiplication;speedcontrol of hydraulic cylinder- metering in, metering out and bleed off circuits.Pilot pressure operated circuits.Hydraulic circuit examples withaccumulator.

10 hours

Module4: Pneumatic power systems

Introduction to Pneumatic systems:Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

10 hours

Module5: Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

10 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Identify and analyse the functional requirements of a fluid power transmission system for a
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	given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000 .
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2002 .
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS:

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol I, II and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

- a. Speed control circuit using metering in and metering out technique
- b. Regenerative and sequencing circuits.
- c. Extend-Retract and Stop system of a linear actuator
- d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

- a. Automatic reciprocating circuit
- b. Speed control circuit
- c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
- d. Electro pneumatic valves and circuit

Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment (5 Marks).

List of Open Source Software/learning website:

1. Simulink
2. SimHydraulics

CONTROL ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Control Engineering	15ME73	04	3-2-0	80	20	3Hrs

Course Objectives	<ol style="list-style-type: none"> 1. Modeling of mechanical, hydraulic, pneumatic and electrical systems. 2. Representation of system elements by blocks and its reduction 3. Transient and steady state response analysis of a system. 4. Frequency response analysis using polar plot. 5. Frequency response analysis using bode plot. 6. Analysis of system using root locus plots. 7. Different system compensators and variable characteristics of linear systems.
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MODULE I

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

(7 Hours)

MODULE 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.
(3 hours)

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

(4 hours)

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

(6 Hours)

MODULE 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.
(3 hours)

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.
(4 hours)

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation
(6 Hours)

MODULE 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins
(14 Hours)

MODULE 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test .

(7 Hours)

Course Outcomes
CO1: Recognize control system and its types , control actions
CO2: Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3: Calculate the gain of the system using block diagram and signal flow graph
CO4: Illustrate the response of 1st and 2nd order systems
CO5: Determine the stability of transfer functions in complex domain and frequency domain
CO6: Employ state equations to study the controllability and observability

TRIBOLOGY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Tribology	15ME742	03	3-0-0	80	20	3Hrs

Course objectives:

CLO1	To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.
CLO2	To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
CLO3	To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
CLO4	To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
CLO5	To introduce the concepts of surface engineering and its importance in tribology.

Module 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

8 hours

Module 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

8 hours

Module 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

10 hours

Module 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

8 hours

Module5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapor phase processes.

Selection of coating for wear and corrosion resistance.

8 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Use of approved Design Data Handbook/charts can be permitted during the examination.

TEXTBOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCES:

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Mechatronics	15ME753	03	3-0-0	80	20	3 Hrs

Course objectives:

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Understand the applications of microprocessors in various systems and to know the functions of each element
4. Demonstrate the integration philosophy in view of Mechatronics technology

MODULE -1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors. 10 Hours

MODULE -2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor. 10 Hours

MODULE -3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot. 10 Hours

MODULE -4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors. 10 Hours

MODULE -5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve,

solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

10 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Develop mechanical, hydraulic, pneumatic and electrical control systems.

TEXT BOOKS:

1. NitaigourPremchandMahalik , Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1stEdition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W.Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1stEdition, 2005 ISBN No. 81-7758-284-4.

REFERENCE BOOKS:

1. Mechatronics by HMT Ltd. – Tata McGrawHill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power , Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN LABORATORY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design Laboratory	15MEL76	02	1-0-2	80	20	3Hrs

Prerequisites: Knowledge of Dynamics and Machines and Design of Machine Elements

COURSE OBJECTIVES:

Students are expected-

1. To understand the natural frequency, logarithmic decrement, damping ratio and damping.
2. To understand the balancing of rotating masses.
3. To understand the concept of the critical speed of a rotating shaft.
4. To understand the concept of stress concentration using Photo elasticity.
5. To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART –A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART –B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.
5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

Scheme of Examination:

One question from Part A:	32 Marks
One question from part B:	32 Marks
Viva- Voce:	16 Marks
Total:	80 Marks

Reference Books:

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

COMPTER INTEGRATED MANUFACTURING LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing LAB	15MEL77	02	1-0-2	80	20	3Hrs

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes.
CLO2	To educate the students on the usage of CAM packages.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations.

3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master- CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Cut the part in single block and auto mode and measure the virtual part on screen.

Post processing of CNC programs for standard CNC control systems like FANUC, SINUMERIC and MISTUBISHI.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time.
CLO6	Understand & write programs for Robotcontrol; understand the operating principles of hydraulics, pneumatics and electropneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	15MEP78	2	0-3-0	100	-	-

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME81	Operations Research	3	2	0	03	80	20	100	4
2	15ME82	Additive Manufacturing	4	0	0	03	80	20	100	4
3	15ME83X	Professional Elective - V	3	0	0	03	80	20	100	3
4	15ME84	Internship / Professional Practice	Industry Oriented			03	50	50	100	2
5	15ME85	Project Phase – II	-	6	-	03	100	100	200	6
6	15MES86	Seminar	-	4	-	-	-	100	100	1
TOTAL			10	12	-		390	310	700	20

Professional Elective-V	
15ME832	Experimental Stress Analysis

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th& 7th semester vacation or 7th& 8th semester vacation.

OPERATIONS RESEARCH

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Operations Research	15ME81	4	3-2-0	80	20	3 Hrs

Course objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

MODULE -1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR,

Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

08 Hours

MODULE -2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

12 Hours

MODULE -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems.

Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

12 Hours

MODULE -4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models. 10 Hours

MODULE -5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method. 08 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD.

Publications, New Delhi – 2007

2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8thEd., McGraw Hill

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

ADDITIVE MANUFACTURING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Additive Manufacturing	15ME82	4	4-0-0	80	20	3 Hrs

Course Objectives:

Students will be able to

1. Understand the additive manufacturing process, polymerization and powder metallurgy process
2. Understand characterisation techniques in additive manufacturing.
3. Acquire knowledge on CNC and Automation.

Module 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries

10 Hours

Module 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, Triacs, Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

8 Hours

Module 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality,

12 Hours

	<p>Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting. Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.</p>	
Module 4		
	<p>NANO MATERIALS & CHARACTERIZATION TECHNIQUES: Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC). Optical Microscopy - principles, Imaging Modes, Applications, Limitations. Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. Transmission Electron Microscopy (TEM) - principles, Imaging Modes, Applications, Limitations.X- Ray Diffraction (XRD) - principles, Imaging Modes, Applications, Limitations.Scanning Probe Microscopy (SPM) - principles, Imaging Modes, Applications, Limitations. Atomic Force Microscopy (AFM) - basic principles, instrumentation, operational modes, Applications, Limitations. Electron Probe Micro Analyzer (EPMA) - Introduction, Sample preparation, Working procedure, Applications, Limitations.</p>	10 Hours
Module 5		
	<p>MANUFACTURING CONTROL AND AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,</p>	10 Hours

	<p>Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)</p> <p>Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity</p> <p>Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.</p>	
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Course Outcomes

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programing and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Experimental Stress Analysis	15ME832	3	3-0-0	80	20	3 Hrs

Course Learning Objectives (CLO's):

1. To use the method of electrical strain gauges to study and characterize the elastic behavior of solid bodies.
2. To measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. To describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
4. To determine stress strain behavior of solid bodies using methods of coating.
5. To conduct stress strain analysis of solid bodies using the methods Holography

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. general consideration in data analysis.

03Hours

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gageconstruction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance' Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

05 Hours

Module -2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

04 Hours

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

02 Hours

Module –3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polarisopes, Isoclinics&Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials

06Hours

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity

02 Hours

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

04 Hours

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings

06 Hours

Module –5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

05Hours

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

05Hours

Course Outcomes (CO's):

At the end of the course, the student will be able to:

1. Explain characterize the elastic behavior of solid bodies.
2. Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. Discuss skills for experimental investigations an accompanying laboratory course is desirable
4. Discuss experimental investigations by predictions by other methods.
5. Describe various coating techniques.

TEXT BOOKS:

1. "**Experimental Stress Analysis**", Dally and Riley, McGraw Hill.
2. "**Experimental Stress Analysis**". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.

REFERENCES BOOKS :

1. "**Photoelasticity Vol I and Vol II**", M.M.Frocht, John Wiley & sons.
2. "**Strain Gauge Primer**", Perry and Lissner,
3. "**Photo Elastic Stress Analysis**", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "**Motion Measurement and Stress Analysis**", Dave and Adams,
5. **Holman, Experimental Methods for Engineers**, Tata McGraw-Hill Companies, 7th Edition, New York, 2007.
6. **B. C. Nakra and K. K. Chaudhry**, Instrumentation, Measurement and Analysis, Tata McGraw-Hill Companies, Inc, New York, 7th Edition, 2006.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	15ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	15MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	15MES86	1	0-4-0	100	-	-

**B.E. Mechanical Engineering
III SEMESTER**

Sl. No.	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics – III	Maths	04			03	60	40	100	4
2	17ME32	Materials Science	ME	04			03	60	40	100	4
3	17ME33	Basic Thermodynamics	ME	03	02		03	60	40	100	4
4	17ME34	Mechanics of Materials	ME	03	02		03	60	40	100	4
5	17ME35A/ 17ME35B	Metal Casting and Welding	ME	04			03	60	40	100	4
		Machine Tools and Operations	ME								
6	17ME36A/ 17ME36B	Computer Aided Machine Drawing	ME	01		4	03	60	40	100	3
		Mechanical Measurements and Metrology	ME	03							
7	17MEL37A/ 17MEL37B	Materials Testing Lab/	ME	1		2	03	60	40	100	2
		Mechanical Measurements and Metrology Lab	ME								
8	17MEL38A/ 17MEL38B	Foundry and Forging Lab	ME	1		2	03	60	40	100	2
		Machine Shop/	ME								
9	17KL/CPH39 /49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	1			01	30	20	50	1
TOTAL				22/24	04	08/04		510	340	850	28

B.E. Mechanical Engineering
IV SEMESTER

Sl. No	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecte	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics – III	Maths	04			03	60	40	100	04
2	17ME42	Kinematics of Machinery	ME	03	02		03	60	40	100	04
3	17ME43	Applied Thermodynamics	ME	03	02		03	60	40	100	04
4	17ME44	Fluid mechanics	ME	03	02		03	60	40	100	04
5	17ME45A/ 17ME45B	Metal Casting and Welding	ME	04			03	60	40	100	04
		Machine Tools and Operations	ME								
6	17ME46 A/ 17ME46B	Computer Aided Machine Drawing	ME	01		4	03	60	40	100	03
		Mechanical Measurements and Metrology	ME	03							
7	17MEL47A/ 17MEL47B	Materials Testing Lab/	ME	1		2	03	60	40	100	02
		Mechanical Measurements and Metrology Lab	ME								
8	17MEL48A/ 17MEL48B	Foundry and Forging Lab	ME	1		2	03	60	40	100	02
		Machine Shop/	ME								
9	17KL/CPH39/ 49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	1			01	30	20	50	1
TOTAL				21/23	06	08/04		510	340	850	28

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME51	Management and Engineering Economics	3	2	0	03	60	40	100	4
2	17ME52	Dynamics of Machinery	3	2	0	03	60	40	100	4
3	17ME53	Turbo Machines	3	2	0	03	60	40	100	4
4	17ME54	Design of Machine Elements - I	3	2	0	03	60	40	100	4
5	17ME55X	Professional Elective-I	3	0	0	03	60	40	100	3
6	17ME56X	Open Elective-I	3	0	0	03	60	40	100	3
7	17MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	60	40	100	2
8	17MEL58	Energy Lab	1	0	2	03	60	40	100	2
TOTAL			20	08	04		480	320	60	40

Professional Elective-I		Open Elective-I	
17ME551	Refrigeration and Air-conditioning	17ME562	Energy and Environment
17ME554	Non Traditional Machining		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Open Elective:** Electives from other technical and/or emerging subject areas.

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME61	Finite Element Analysis	3	2	0	03	60	40	100	4
2	17ME62	Computer integrated Manufacturing	4	0	0	03	60	40	100	4
3	17ME63	Heat Transfer	3	2	0	03	60	40	100	4
4	17ME64	Design of Machine Elements -II	3	2	0	03	60	40	100	4
5	17ME65X	Professional Elective-II	3	0	0	03	60	40	100	3
6	17ME66X	Open Elective-II	3	0	0	03	60	40	100	3
7	17MEL67	Heat Transfer Lab	1	0	2	03	60	40	100	2
8	17MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	60	40	100	2
TOTAL			21	6	04		480	320	60	40

Professional Elective-II		Open Elective-II	
17ME653	Metal Forming	17ME663	Maintenance engineering
17ME655	Automobile Engineering	17ME664	Total Quality Management

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Open Elective:** Electives from other technical and/or emerging subject areas.

CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016
B.E. Mechanical Engineering

VII semester

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME71	Energy Engineering	3	2	0	03	60	40	100	4
2	17ME72	Fluid Power Systems	4	0	0	03	60	40	100	4
3	17ME73	Control Engineering	3	2	0	03	60	40	100	4
4	17ME74X	Professional Elective - III	3	0	0	03	60	40	100	3
5	17ME75X	Professional Elective-IV	3	0	0	03	60	40	100	3
6	17MEL76	Design Lab	1	0	2	03	60	40	100	2
7	17MEL77	CIM Lab	1	0	2	03	60	40	100	2
8	17MEP78	Project Phase – I	-	-	-	-	60	40	100	2
TOTAL			18	4	04		480	320	60	24

Professional Elective-III		Professional Elective-IV	
17ME742	Tribology	17ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016**

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination			Credits	
			Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks		Total Marks
1	17ME81	Operations Research	3	2	0	03	60	40	100	4
2	17ME82	Additive Manufacturing	4	0	0	03	60	40	100	4
3	17ME83X	Professional Elective - V	3	0	0	03	60	40	100	3
4	17ME84	Internship / Professional Practice	Industry Oriented			03	60	40	60	40
5	17ME85	Project Phase – II	-	6	-	03	60	40	200	6
6	17MES86	Seminar	-	4	-	-	60	40	100	1
TOTAL			10	12	-		480	320	700	20
Professional Elective-V										
15ME832			Experimental Stress Analysis							

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th & 7th semester vacation or 7th & 8th semester vacation

MATERIAL SCIENCE

B.E, III Semester, Mechanical Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME32	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- The foundation for understanding the structure and various modes of failure in materials common in mechanical engineering.
- Topics are designed to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites.
- The means of modifying such properties, as well as the processing and failure of materials.
- Concepts of use of materials for various applications are highlighted.

Module - 1

Basics, Mechanical Behavior, Failure of Materials

Introduction to Crystal Structure – Coordination number, atomic packing factor, Simple Cubic, BCC, FCC and HCP Structures, Crystal imperfections – point, line, surface and volume imperfections, Atomic Diffusion: Phenomenon, Fick's laws of diffusion; Factors affecting diffusion.

Mechanical Behavior:

Stress-strain diagrams showing ductile and brittle behavior of materials, Engineering and true strains, Linear and non-linear elastic behavior and properties, Mechanical properties in plastic range. Stiffness, Yield strength, Offset Yield strength, Ductility, Ultimate Tensile strength, Toughness, Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals

Fracture: Type I, Type II and Type III,

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, Fatigue properties, S-N diagram, Fatigue testing. **Creep:** Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness.

Module - 2

Alloys, Steels, Solidification

Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules), Binary phase diagrams: Eutectic, and Eutectoid systems, Lever rule, Substitutional and interstitial solid solutions, Intermediate phases, Gibbs phase rule Effect of non- equilibrium cooling, Coring and Homogenization Iron-Carbon (Cementite) diagram: description of phases, Specifications of steels. Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, Crystal growth, Numerical on lever rule

Module - 3

Heat Treatment, Ferrous and Non-Ferrous Alloys

Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering, Austempering, Concept of hardenability, Factors affecting it hardenability, surface hardening methods: carburizing, cyaniding, nitriding, flame hardening and induction hardening, Age hardening of aluminum-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron, Malleable iron, SG iron and steel,

Module - 4**Other Materials, Material Selection**

Ceramics: Structure types and properties and applications of ceramics. Mechanical / Electrical behavior and processing of Ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behaviors and processing of plastics, Failure of plastics.

Other materials: Smart materials and Shape Memory alloys, properties and applications.

Module - 5**Composite Materials**

Composite materials - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Fundamentals of production of composites, Processes for production of composites, Constitutive relations of composites, Numerical problems on determining properties of composites.

Course outcomes:

- ☐ Describe the mechanical properties of metals, their alloys and various modes of failure.
- ☐ Understand the microstructures of ferrous and non-ferrous materials to mechanical properties.
- ☐ Explain the processes of heat treatment of various alloys.
- ☐ Understand the properties and potentialities of various materials available and material selection procedures.
- ☐ Know about composite materials and their processing as well as applications.

TEXT BOOKS:

1. Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009.
2. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006.

REFERENCE BOOKS

1. V.Raghavan, Materials Science and Engineering, , PHI, 2002
2. Donald R. Asklund and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4th Ed., 2003.
3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill.
4. ASM Handbooks, American Society of Metals.

BASIC THERMODYNAMICS
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME33	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **Learn about thermodynamic systems and boundaries**
- ▯ **Study the basic laws of thermodynamics including, conservation of mass, conservation of energy or first law , second law and Zeroth law.**
- ▯ **Understand various forms of energy including heat transfer and work**
- ▯ **Identify various types of properties (e.g., extensive and intensive properties)**
- ▯ **Use tables, equations, and charts, in evaluation of thermodynamic properties**
- ▯ **Apply conservation of mass, first law, and second law in thermodynamic analysis of systems (e.g., turbines, pumps, compressors, heat exchangers, etc.)**
- ▯ **Enhance their problem solving skills in thermal engineering**

Module - 1

Fundamental Concepts & Definitions: Thermodynamic definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive , extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, constant pressure gas thermometer, mercury in glass thermometer

Work and Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention. Problems

L1 , L2

Module - 2

First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy as a property, modes of energy, Extension of the First law to control volume; steady flow energy equation(SFEE), important applications.

Second Law of Thermodynamics: limitations of first law of thermodynamics Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir, Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Carnot cycle, Carnot principles. Problems

L1 , L2, L3

Module - 3

Reversibility: Definitions of a reversible process, reversible heat engine, importance and superiority of a reversible heat engine and irreversible processes; factors that make a process irreversible, reversible heat engines. Unresisted expansion, remarks on Carnot's engine, internal and external reversibility, Definition of the thermodynamic temperature scale. Problems

Entropy: Clausius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, entropy as a coordinate.

L1 , L2, L3

Module - 4

Availability, Irreversibility and General Thermodynamic relations. Introduction, Availability (Exergy), Unavailable energy, Relation between increase in unavailable energy and increase in entropy. Maximum work, maximum useful work for a system and control volume, irreversibility, second law efficiency.

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

L1 , L2, L3

Module - 5

Ideal gases: Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air- Water mixtures and related properties.

Real gases – Introduction , Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Beattie-Bridgeman equation , Law of corresponding states, compressibility factor; compressibility chart. Difference between Ideal and real gases.

L1 , L2

Course outcomes:

- Explain thermodynamic systems, properties, Zeroth law of thermodynamics, temperature scales and energy interactions.
- Determine heat, work, internal energy, enthalpy for flow & non flow process using First and Second Law of Thermodynamics.
- Interpret behavior of pure substances and its applications to practical problems.
- Determine change in internal energy, change in enthalpy and change in entropy using TD relations for ideal gases.
- Calculate Thermodynamics properties of real gases at all ranges of pressure, temperatures using modified equation of state including Vander Waals equation, Redlich Wong equation and Beattie-

TEXT BOOKS:

1. Basic Engineering Thermodynamics, A.Venkatesh, Universities Press, 2008
2. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS

1. Thermodynamics, An Engineering Approach, YunusA.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002
2. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. Fundamentals of Classical Thermodynamics, G.J.VanWylen and R.E.Sonntag, Wiley Eastern.
4. An Introduction to Thermodynamics, Y.V.C.Rao, Wiley Eastern, 1993,
5. B.K Venkanna, Swati B. Wadavadagi "Basic Thermodynamics, PHI, New Delhi, 2010

MECHANICS OF MATERIALS
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME34	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes.**
- ▯ **Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.**
- ▯ **Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads.**
- ▯ **Explain the structural behavior of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion.**
- ▯ **Understand the concept of stability and derive crippling loads for columns.**
- ▯ **Understand the concept of strain energy and compute strain energy for applied loads.**

Module - 1

Stress and Strain: Introduction, Hooke's law, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson's ratio, Generalized Hooke's law, Bulk modulus, Relationship between elastic constants.

Module - 2

Analysis of Stress and Strain: Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions.

Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

Module - 3

Shear Forces and Bending Moments: Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.

Stress in Beams: Pure bending, Curvature of a beam, Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, 'I' and 'T' cross sections, Flexure Formula, Bending Stresses.

Module - 4

Torsion: Circular solid and hollow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin walled sections

Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with other support conditions, Effective length of columns, Secant formula for columns.

Module - 5

Strain Energy: Castigliano's theorem I and II, Load deformation diagram, Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion.

Theories of Failure: Maximum Principal stress theory, Maximum shear stress theory.

Course outcomes:

- ☐ Understand simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
- ☐ Determine stresses, strains and deformations in bars with varying circular and rectangular cross-sections subjected to normal and temperature loads
- ☐ Determine plane stress, principal stress, maximum shear stress and their orientations using analytical method and Mohr's circle
- ☐ Determine the dimensions of structural members including beams, bars and rods using Energy methods and also stress distribution in thick and thin cylinders
- ☐ Draw SFD and BMD for different beams including cantilever beams, simply supported beams and overhanging beams subjected to UDL, UVL, Point loads and couples
- ☐ Determine dimensions, bending stress, shear stress and its distribution in beams of circular, rectangular, symmetrical I and T sections subjected to point loads and UDL
- ☐ Determine the dimensions of shafts based on torsional strength, rigidity and flexibility and also elastic stability of columns using Rankin's and Euler's theory

TEXT BOOKS:

1. James M Gere, Barry J Goodno, Strength of Materials, Indian Edition, Cengage Learning, 2009.
2. R Subramanian, Strength of Materials, Oxford, 2005.

REFERENCE BOOKS

1. S S Rattan, Strength of Materials, Second Edition, McGraw Hill, 2011.
2. Ferdinand Beer and Russell Johnston, Mechanics of materials, Tata McGraw Hill, 2003.

METAL CASTING AND WELDING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 A /45A	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To provide detailed information about the moulding processes.**
- ▯ **To provide knowledge of various casting process in manufacturing.**
- ▯ **To impart knowledge of various joining process used in manufacturing.**
- ▯ **To provide adequate knowledge of quality test methods conducted on welded and casted components.**

Module - 1

INTRODUCTION & BASIC MATERIALS USED IN FOUNDRY

Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy.

Introduction to casting process & steps involved. Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance.

Sand molding: Types of base sand, requirement of base sand. Binder, Additives definition, need and types

Preparation of sand molds: Molding machines- Jolt type, squeeze type and Sand slinger. Study of important molding process: Green sand, core sand, dry sand, sweep mold, CO2 mold, shell mold, investment mold, plaster mold, cement bonded mold. Cores: Definition, need, types. Method of making cores, concept of gating (top, bottom, parting line, horn gate) and risering (open, blind) Functions and types

Module - 2

MELTING & METAL MOLD CASTING METHODS

Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

Casting using metal molds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes

Module - 3

SOLIDIFICATION & NON FERROUS FOUNDRY PRACTICE

Solidification: Definition, Nucleation, solidification variables, Directional solidification-need and methods. Degasification in liquid metals-Sources of gas, degasification methods.

Fettling and cleaning of castings: Basic steps involved. Sand Casting defects- causes, features and remedies. Advantages & limitations of casting process

Nonferrous foundry practice: Aluminum castings - Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, dressing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations.

Module - 4

WELDING PROCESS

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).

Special type of welding: Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding.

Module - 5

SOLDERING , BRAZING AND METALLURGICAL ASPECTS IN WELDING

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds& Residual stresses, Concept of electrodes, filler rod and fluxes. Welding defects- Detection, causes & remedy.

Soldering, brazing, gas welding: Soldering, Brazing, Gas Welding: Principle, oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

Inspection methods: Methods used for inspection of casting and welding. Visual, magnetic particle, fluorescent particle, ultrasonic. Radiography, eddy current, holography methods of inspection.

Course outcomes:

- ☐ Describe the casting process, preparation of Green, Core, dry sand molds and Sweep, Shell, Investment and plaster molds.
- ☐ Explain the Pattern, Core, Gating, Riser system and Jolt, Squeeze, Sand Slinger Molding Machines.
- ☐ Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces.
- ☐ Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings.
- ☐ Explain the Solidification process and Casting of Non-Ferrous Metals.
- ☐ Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes used in manufacturing.
- ☐ Explain the Resistance spot, Seam, Butt, Projection, Friction, Explosive, Thermit, Laser and Electron Beam Special type of welding process used in manufacturing.
- ☐ Describe the Metallurgical aspects in Welding and inspection methods for the quality assurance of components made of casting and joining process.

TEXT BOOKS:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House,5th Revised Edition 2009.
2. "Manufacturing & Technology": Foundry Forming and Welding,P.N.Rao, 3rd Ed., Tata McGrawHill, 2003.

REFERENCE BOOKS

1. "Process and Materials of Manufacturing", Roy A Lindberg, 4th Ed.Pearson Edu. 2006.
2. "Manufacturing Technology", SeropeKalpakjian, Steuen. R. Sechmid,Pearson Education Asia, 5th Ed. 2006.
3. "Principles of metal casting", Rechar W. Heine, Carl R. Loper Jr., Philip C. Rosenthal, Tata McGraw Hill Education Private Limited Ed.1976.

MACHINE TOOLS AND OPERATIONS
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 B / 45B	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To introduce students to different machine tools in order to produce components having different shapes and sizes.**
- ▯ **To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.**
- ▯ **To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.**

Module - 1

MACHINE TOOLS

Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaping machine, planing machine, grinding machine **[Simple sketches showing major parts of the machines]**

Module - 2

MACHINING PROCESSES

Introduction, Types of motions in machining, turning and Boring, Shaping, Planing and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.

[Sketches pertaining to relative motions between tool and work piece only]

Module - 3

CUTTING TOOL MATERIALS, GEOMETRY AND SURFACE FINISH

Introduction, desirable Properties and Characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish.

Machining equations for cutting operations: Turning, Shaping, Planing, slab milling, cylindrical grinding and internal grinding, Numerical Problems

Module - 4

MECHANICS OF MACHINING PROCESSES

Introduction, Chip formation, Orthogonal cutting, Merchant's model for orthogonal cutting, Oblique cutting, Mechanics of turning process, Mechanics of drilling process, Mechanics of milling process, Numerical problems.

Module - 5

TOOL WEAR, TOOL LIFE: Introduction, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life, machinability, Numerical problems

ECONOMICS OF MACHINING PROCESSES: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Numerical problems

Course outcomes:

- ▯ **Explain the construction & specification of various machine tools.**
- ▯ **Describe various machining processes pertaining to relative motions between tool & work piece.**
- ▯ **Discuss different cutting tool materials, tool nomenclature & surface finish.**
- ▯ **Apply mechanics of machining process to evaluate machining time.**
- ▯ **Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.**

TEXT BOOKS:

1. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, 2003
2. All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006

REFERENCE BOOKS

1. Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition.
2. Metal cutting principles, Milton C. Shaw, Oxford University Press, Second Edition, 2005.

COMPUTER AIDED MACHINE DRAWING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 A / 46A	CIE Marks	40
Number of Hours/Week	05	SEE Marks	60
Total Number of Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ☐ To acquire the knowledge of CAD software and its features.
- ☐ To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views
- ☐ To familiarize the students with Indian Standardson drawing practices.
- ☐ To impart knowledge of thread forms, fasteners, keys,joints and couplings.
- ☐ To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages.
- ☐ To acquire the knowledge of limits,tolerances and fitspertaining to machine drawings.

PART A

INTRODUCTION TO COMPUTER AIDED SKETCHING

Review of graphic interface of the software. Review of basic sketching commands and navigational commands.

2 Hours

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids), True shape of section.

4 Hours

Orthographic views: Conversion of pictorial views into orthographic projections of simple machine partswith or without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines.

4 Hours

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

8 Hours

PART B

Keys and Joints: Parallel, Taper, Feather Key, Gib head key and Woodruff key

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods.8 Hours

Couplings: Split muff coupling, Protected type flange coupling, Pin (bush) type flexible coupling, Oldham's coupling and Universal coupling (Hook's Joint).

6 Hours

PART C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry. 3 Hours

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Lathe square tool post

15 Hours

Course outcomes:

- ▯ Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
- ▯ Orthographic views of machine parts with and without sectioning in 2D.
- ▯ Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
- ▯ Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
- ▯ Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D
- ▯ single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
- ▯ Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
- ▯ assemblies from the part drawings with limits ,fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal, Published by Charotar Publishing House, 1999.
3. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006.

REFERENCE BOOKS

1. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007.
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

Internal Assessment: 20 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (40 Marks)

- (a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 20Marks.
- (b) Internal Assessment test in the same pattern as that of the main examination: 20 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.

Student has to answer one question each from Part A, Part B for 15 marks each and one question from Part C for 50 marks.

Part A 1 x 25	= 25 Marks
Part B 1 x 25	= 25 Marks
Part C 1 x 50	= <u>50 Marks</u>
Total	= 100 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.

MECHANICAL MEASUREMENTS AND METROLOGY
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 B / 46B	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ **Understand metrology, its advancements & measuring instruments,**
- ▯ **Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.**
- ▯ **Equip with knowledge of limits, fits, tolerances and gauging.**
- ▯ **Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.**
- ▯ **Understand the measurement of Force, Torque, Pressure, Temperature and Strain.**

Module - 1

MACHINE TOOLS

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement.

System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars (Numerical Problems), standardization.

Linear Measurement and angular measurements:

Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112).

Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.

Module - 2

System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators:

Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, , LVDT, Pneumatic- back pressure gauges, Solex comparators and optical comparators- Zeiss ultra-optimizer.

Module - 3**Measurement of screw thread and gear:**

Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.

Advances in metrology:

Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines-constructural features, applications.

Module - 4**Measurement systems and basic concepts of measurement methods:**

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

Module - 5**Force, Torque and Pressure Measurement:**

Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature:

Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors.

Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.

Course outcomes:

- ☐ **Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.**
- ☐ **Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.**
- ☐ **Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.**
- ☐ **Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Solex comparators and Zeiss Ultra Optimeter**
- ☐ **Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.**
- ☐ **Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile**

- **Understand laser interferometers and Coordinate measuring machines.**
- **Explain measurement systems, transducers, intermediate modifying devices and terminating devices.**
- **Describe functioning of force, torque, pressure, strain and temperature measuring devices.**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, Delhi, 2009.

REFERENCE BOOKS

1. **Engineering Metrology and Measurements**, Bentley, Pearson Education.
2. **Theory and Design for Mechanical Measurements, III edition**, Richard S Figliola, Donald E Beasley, WILEY India Publishers.
3. **Engineering Metrology**, Gupta I.C., Dhanpat Rai Publications.
4. **Deoblin's Measurement system**, Ernest Deoblin, Dhaneshmanick, McGraw–Hill.
5. **Engineering Metrology and Measurements**, N.V. Raghavendra and L. Krishnamurthy, Oxford University Press.

MATERIALS TESTING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 A / 47A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. To understand mechanical behavior of various engineering materials by conducting standard tests.
3. To learn material failure modes and the different loads causing failure.
4. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials.
To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel.
Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel.
Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. To study the defects of Cast and Welded components using Non-destructive tests like:
 - a) Ultrasonic flaw detection
 - b) Magnetic crack detection
 - c) Dye penetration testing.

PART B

1. Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
2. Torsion Test on steel bar.
3. Bending Test on steel and wood specimens.
4. Izod and Charpy Tests on Mild steel and C.I Specimen.
5. To study the wear characteristics of ferrous and non-ferrous materials under different parameters.
6. Fatigue Test (demonstration only).

Course outcomes:

- ▯ **Acquire experimentation skills in the field of material testing.**
- ▯ **Develop theoretical understanding of the mechanical properties of materials by performing experiments.**
- ▯ **Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.**
- ▯ **Apply the knowledge of testing methods in related areas.**
- ▯ **Know how to improve structure/behavior of materials for various industrial applications.**

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 B / 47B	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

PART – A : MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART B : METROLOGY

1. Measurement using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer OR
 - b) Drill tool Dynamometer.
5. Measurement of Screw threads Parameters using two wire or Three-wire methods.
6. Measurement of Surface roughness, using Tally Surf/Mechanical Comparator.
7. Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer.
8. Calibration of Micrometer using slip gauges.
9. Measurement using Optical Flats.

Course outcomes:

- ▯ To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer..
- ▯ To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
- ▯ To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats..
- ▯ To measure cutting tool forces using Lathe/Drill tool dynamometer..
- ▯ To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.
- ▯ To measure surface roughness using Tally Surf/ Mechanical Comparator.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

FOUNDRY AND FORGING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38A / 48A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ☐ **To provide an insight into different sand preparation and foundry equipment.**
- ☐ **To provide an insight into different forging tools and equipment.**
- ☐ **To provide training to students to enhance their practical skills.**
- ☐ **To practically demonstrate precautions to be taken during casting and hot working.**
- ☐ **To develop team qualities and ethical principles.**

PART-A

1. Testing of Molding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Sieve Analysis to find Grain Fineness Number(GFN) of Base Sand
4. Clay content determination in Base Sand.

PART-B

2. Foundry Practice

1. Use of foundry tools and other equipment's.
2. Preparation of molding sand mixture.
3. Preparation of green sand molds using two molding boxes kept ready for pouring.
 - ☐ Using patterns (Single piece pattern and Split pattern)
 - ☐ Without patterns.
 - ☐ Incorporating core in the mold. (Core boxes).
 - ☐ Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations :

Use of forging tools and other equipment's

- Calculation of length of the raw material required to prepare the model considering scale losses.
- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Demonstration of forging model using Power Hammer.

Course outcomes:

Students will be able to

- Demonstrate various skills of sand preparation, molding.**
- Demonstrate various skills of forging operations.**
- Work as a team keeping up ethical principles.**

Scheme of Examination:

One question is to be set from Part-A 30 Marks

One question is to be set from either Part-B or Part-C 50 Marks

Viva – Voce 20 Marks

Total 100 Marks

MACHINE SHOP
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38B / 48B	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ▯ **To provide an insight to different machine tools, accessories and attachments**
- ▯ **To train students into machining operations to enrich their practical skills**
- ▯ **To inculcate team qualities and expose students to shop floor activities**
- ▯ **To educate students about ethical , environmental and safety standards**

PART-A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART-B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper
 Cutting of Gear Teeth using Milling Machine

PART C

For demonstration

Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder. Demonstration of surface milling /slot milling

Course outcomes:

- ▯ **Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves etc using shaper**
- ▯ **Perform gear tooth cutting using milling machine**
- ▯ **Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling**
- ▯ **Demonstrate precautions and safety norms followed in Machine Shop**
- ▯ **Exhibit interpersonal skills towards working in a team**

Scheme of Examination:

One Model from Part – A 50 Marks

One Model from Part – B 30 Marks

Viva Voce 20 Marks

Total 100 Marks

KINEMATICS OF MACHINES
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME42	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. Familiarize with mechanisms and motion analysis of mechanisms.
2. Understand methods of mechanism motion analysis and their characteristics.
3. Analyse motion of planar mechanisms, gears, gear trains and cams.

Module - 1

Introduction: Definitions: Link, kinematic pairs, kinematic chain, mechanism, structure, degrees of freedom, Classification links, Classification of pairs based on type of relative motion, Grubler's criterion, mobility of mechanism, Grashoff's criteria, inversions of Grashoff's chain.
Mechanisms: Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling, Straight line motion mechanisms, Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, condition for correct steering, Ackerman steering gear mechanism.

Module - 2

Velocity and Acceleration Analysis of Mechanisms (Graphical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Coriolis's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.
Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's theorem, Determination of linear and angular velocity using instantaneous center method.
Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

Module - 3

Velocity and Acceleration Analysis of Mechanisms (Analytical Method): Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method.
Freudenstein's equation for four bar mechanism and slider crank mechanism. **Function Generation** for four bar mechanism.

Module - 4

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference.
Gear Trains: Simple gear trains, compound gear trains.
 Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains.

Module - 5

Cams: Types of cams, types of followers. displacement, velocity and acceleration curves for uniform velocity, Simple Harmonic Motion, Uniform Acceleration, Retardation and Cycloidal motion.

Cam profiles: disc cam with reciprocating followers such as knife-edge, roller and flat-face followers, inline and offset.

Analysis of Cams: Analysis of arc cam with flat faced follower.

Course outcomes:

1. Identify mechanisms with basic understanding of motion.
2. Comprehend motion analysis of planar mechanisms, gears, gear trains and cams.
3. Carry out motion analysis of planar mechanisms, gears, gear trains and cams.

TEXT BOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009.

REFERENCE BOOKS

- Michael M Stanisc, Mechanisms and Machines-Kinematics, Dynamics and Synthesis, Cengage Learning, 2016.
2. Sadhu Singh, **Theory of Machines**, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006.

APPLIED THERMODYNAMICS
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME43	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To have a working knowledge of basic performance of Gas power cycles.**
- ▯ **To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy**
- ▯ **To understand and evaluate the performance of steam power cycles their various Engineering applications**
- ▯ **To know how fuel burns and their thermodynamic properties.**
- ▯ **To Understand mechanism of power transfer through belt, rope, chain and gear drives in I C Engines**
- ▯ **To determine performance parameters of refrigeration and air-conditioning systems.**
- ▯ **Evaluate the performance parameters of reciprocating air compressor as a function of receiver pressure.**

Module - 1

Gas Power Cycles: Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T-s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle. Inter-cooling and reheating in gas turbine cycles. Jet propulsion: Introduction to the principles of jet propulsion,

Module - 2

Vapour Power Cycles: Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-s diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in Vapour power cycles, Binary Vapour cycles.

Module - 3

Combustion Thermodynamics: Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio. Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion. Combustion efficiency. Dissociation and equilibrium, emissions.

I.C.Engines: Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels.

Module - 4

Refrigeration Cycles: Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Any one case study on cold storage or industrial refrigerator. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system. Steam jet refrigeration.

Psychrometrics and Air-conditioning Systems: Properties of Atmospheric air, and Psychrometric properties of Air, Psychrometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of two moist air streams. Cooling towers.

Module - 5

Reciprocating Compressors: Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression.

Steam nozzles: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow

Course outcomes:

- **Apply thermodynamic concepts to analyze the performance of gas power cycles including propulsion systems.**
- **Evaluate the performance of steam turbine components.**
- **Understand combustion of fuels and combustion processes in I C engines including alternate fuels and pollution effect on environment.**
- **Apply thermodynamic concepts to analyze turbo machines.**
- **Determine performance parameters of refrigeration and air-conditioning systems.**
- **Understand the principles and applications of refrigeration systems.**
- **Analyze air-conditioning processes using the principles of psychrometry and Evaluate cooling and heating loads in an air-conditioning system.**
- **Understand the working, applications, relevance of air and identify methods for performance improvement.**

TEXT BOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.
2. Ambekar A. G., Mechanism and Machine Theory, PHI, 2009. Thermodynamics an engineering approach, by Yunus A. Cengel and Michael A. Boles. Tata McGraw hill Pub. Sixth edition, 2008.
3. Basic and Applied Thermodynamics" by P .K. Nag, Tata McGraw Hill, 2nd Edi. 2009
4. Fundamentals of Thermodynamics by G.J. Van Wylen and R.E. Sonntag, Wiley Eastern. Fourth edition 1993.

REFERENCE BOOKS:

1. Thermodynamics for engineers, Kenneth A. Kroos and Merle C. Potter, Cengage Learning, 2016
2. Principles of Engineering Thermodynamics, Michael J, Moran, Howard N. Shapiro, Wiley, 8th Edition
3. An Introduction to Thermo Dynamics by Y.V.C.Rao, Wiley Eastern Ltd, 2003.
4. Thermodynamics by Radhakrishnan. PHI, 2nd revised edition.
5. I.C Engines by Ganeshan.V. Tata McGraw Hill, 4th Edi. 2012.
6. I.C.Engines by M.L.Mathur & Sharma. Dhanpat Rai & sons- India

FLUID MECHANICS**B.E, IV Semester, Mechanical Engineering****[As per Choice Based Credit System (CBCS) scheme]**

Course Code	17ME44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04**Course Objectives:**

- ▯ To have a working knowledge of the basic properties of fluids and understand the continuum approximation
- ▯ To Calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy
- ▯ To understand the flow characteristic and dynamics of flow field for various Engineering applications
- ▯ To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
- ▯ To discuss the main properties of laminar and turbulent pipe flow and appreciate their differences and the concept of boundary layer theory.
- ▯ Understand the concept of dynamic similarity and how to apply it to experimental modeling
- ▯ To appreciate the consequences of compressibility in gas flow and understand the effects of friction and heat transfer on compressible flows

Module - 1

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Concept of continuum, types of fluids etc, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, Absolute, gauge, atmospheric and vacuum pressures pressure measurement by simple, differential manometers and mechanical gauges.

Fluid Statics: Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid. Buoyancy, center of buoyancy, meta center and meta centric height its application in shipping, stability of floating bodies.

Module - 2**Fluid Kinematics and Dynamics:**

Fluid Kinematics: Types of Flow-steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates. Rotation, vorticity and circulation, Laplace equation in velocity potential and Poisson equation in stream function, flow net, Problems.

Fluid Dynamics:

Momentum equation, Impacts of jets- force on fixed and moving vanes, flat and curved. Numericals. Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem such as venturi meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc., related numericals.

Module - 3

Laminar and turbulent flow: Reynolds Number, Entrance flow and Developed flow, Navier-Stokes Equation (no derivation), Laminar flow between parallel plates, Poiseuille equation – velocity profile, Couette flow, Fully developed laminar flow in circular pipes, Hagen - Poiseuille

equation, related numericals.

Energy consideration in pipe flow, Loss of Pressure Head due to Fluid Friction, Darcy Weishach formula, major and minor losses in pipes, Commercial pipe, Colebrook equation, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numericals and simple pipe design problems.

Module - 4

Flow over bodies: Development of boundary layer, Prandtl's boundary layer equations, Blasius solution, laminar layer over a flat plate, boundary layer separation and its control.

Basic concept of Lift and Drag, Types of drag, Co-efficient of drag and lift, streamline body and bluff body, flow around circular bodies and airfoils, Lift and drag on airfoil, Numerical problems.

Dimensional analysis: Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Rayleigh's method, Buckingham Pi theorem, Similitude and Model studies. Numerical problems

Module - 5

Compressible Flows: Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.

Introduction to CFD: Necessity, limitations, philosophy behind CFD, and applications.

Course outcomes:

- Identify and calculate the key fluid properties used in the analysis of fluid behavior.
- Understand and apply the principles of pressure, buoyancy and floatation
- Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of mechanical and chemical engineering.
- Understand and apply the principles of fluid kinematics and dynamics.
- Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables.
- Understand the basic concept of compressible flow and CFD

TEXT BOOKS:

1. Fluid Mechanics (SI Units), Yunus A. Cengel John M.Cimbala, 3rd Ed., Tata a. McGraw Hill, 2014.
2. Fluid Mechanics, F M White, McGraw Hill Publications Eighth edition. 2016
3. Mechanics of Fluids, Merle C. Potter, Devid C. Wiggerrt, Bassem H. Ramadan, Cengage learning, Fourth editions 2016.

REFERENCE BOOKS

1. Fundamentals of Fluid Mechanics by Munson, Young, Okiishi&Huebsch, John Wiley Publications.7th edition.
2. Fluid Mechanics, Pijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
3. Fluid Mechanics, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006.
4. Introduction to Fluid Mechanics by Fox, McDonald, John Wiley Publications,8th edition.

MACHINE TOOLS AND OPERATIONS
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME35 B / 45B	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- To introduce students to different machine tools in order to produce components having different shapes and sizes.
- To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
- To develop the knowledge on mechanics of machining process and effect of various parameters on economics of machining.

Module - 1

MACHINE TOOLS

Introduction, Classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaping machine, planing machine, grinding machine [Simple sketches showing major parts of the machines]

Module - 2

MACHINING PROCESSES

Introduction, Types of motions in machining, turning and Boring, Shaping, Planing and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.

[Sketches pertaining to relative motions between tool and work piece only]

Module - 3

CUTTING TOOL MATERIALS, GEOMETRY AND SURFACE FINISH

Introduction, desirable Properties and Characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish.

Machining equations for cutting operations: Turning, Shaping, Planing, slab milling, cylindrical grinding and internal grinding, Numerical Problems

Module - 4

MECHANICS OF MACHINING PROCESSES

Introduction, Chip formation, Orthogonal cutting, Merchant's model for orthogonal cutting, Oblique cutting, Mechanics of turning process, Mechanics of drilling process, Mechanics of milling process, Numerical problems.

Module - 5

TOOL WEAR, TOOL LIFE: Introduction, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life, machinability, Numerical problems

ECONOMICS OF MACHINING PROCESSES: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Numerical problems

Course outcomes:

- Explain the construction & specification of various machine tools.

- Describe various machining processes pertaining to relative motions between tool & workpiece.
- Discuss different cutting tool materials, tool nomenclature & surface finish.
- Apply mechanics of machining process to evaluate machining time.
- Analyze tool wear mechanisms and equations to enhance tool life and minimize machining cost.

TEXT BOOKS:

1. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, 2003
2. All about Machine Tools, Heinrich Gerling, New Age International Publishers revised 2nd Edition, 2006

REFERENCE BOOKS

1. Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylor & Francis, Third Edition.
2. Metal cutting principles, Milton C. Shaw, Oxford University Press, Second Edition, 2005.

COMPUTER AIDED MACHINE DRAWING
B.E, III/IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36 A / 46A	CIE Marks	40
Number of Hours/Week	05	SEE Marks	60
Total Number of Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ To acquire the knowledge of CAD software and its features.
- ▯ To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views
- ▯ To familiarize the students with Indian Standard drawing practices.
- ▯ To impart knowledge of thread forms, fasteners, keys, joints and couplings.
- ▯ To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using CAD packages.
- ▯ To acquire the knowledge of limits, tolerances and fits pertaining to machine drawings.

PART A

INTRODUCTION TO COMPUTER AIDED SKETCHING

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. 2 Hours

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids), True shape of section. 4 Hours

Orthographic views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines. 4 Hours

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw. 8 Hours

PART B

Keys and Joints: Parallel, Taper, Feather Key, Gib head key and Woodruff key

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods. 8 Hours

Couplings: Split muff coupling, Protected type flange coupling, Pin (bush) type flexible coupling, Oldham's coupling and Universal coupling (Hook's Joint).

6 Hours

PART C

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry.

3 Hours

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Lathe square tool post

15 Hours

Course outcomes:

- ▯ Sections of pyramids, prisms, cubes, cones and cylinders resting on their bases in 2D
- ▯ Orthographic views of machine parts with and without sectioning in 2D.
- ▯ Sectional views for threads with terminologies of ISO Metric, BSW, square and acme, sellers and American standard threads in 2D.
- ▯ Hexagonal and square headed bolt and nut with washer, stud bolts with nut and lock nut, flanged nut, slotted nut, taper and split pin for locking counter sunk head screw, grub screw, Allen screw assemblies in 2D
- ▯ Parallel key, Taper key, and Woodruff Key as per the ISO standards in 2D
- ▯ single and double riveted lap joints, butt joints with single/double cover straps, cotter and knuckle joint for two rods in 2D
- ▯ Sketch split muff, protected type flanged, pin type flexible, Oldham's and universal couplings in 2D
- ▯ assemblies from the part drawings with limits, fits and tolerance given for Plummer block, Ram bottom safety valve, I.C. Engine connecting rod, Screw Jack, Tailstock of lathe, Machine Vice and Lathe square tool post in 2D and 3D

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat&V.M.Panchal, Published by Charotar Publishing House, 1999.
3. 'Machine Drawing', N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata Mc.Grawhill, 2006.

REFERENCE BOOKS

1. "A Text Book of Computer Aided Machine Drawing", S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2007.
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash publication.

Internal Assessment: 20 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (40 Marks)

- (a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 20 Marks.
- (b) Internal Assessment test in the same pattern as that of the main examination: 20 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.

Student has to answer one question each from Part A, Part B for 15 marks each and one question from Part C for 50 marks.

Part A 1 x 25 = 25 Marks

Part B 1 x 25 = 25 Marks

Part C 1 x 50 = 50 Marks

Total = 100 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (15ME36A/46A) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B, 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.

MECHANICAL MEASUREMENTS AND METROLOGY
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME36B / 46B	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

Credits – 03

Course Objectives:

- Understand metrology, its advancements & measuring instruments,
- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements, Screw thread and gear measurement & comparators.
- Equip with knowledge of limits, fits, tolerances and gauging.
- Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.
- Understand the measurement of Force, Torque, Pressure, Temperature and Strain.

MODULE 1

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars(Numerical problems), standardization.

Linear Measurement and angular measurements:

Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112).

Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.

MODULE 2

System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances.

Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Comparators:

Functional requirements, classification, mechanical- Johnson Mikrokator, sigma comparators, dial indicator, electrical- principles, , LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimizer.

MODULE 3**Measurement of screw thread and gear:**

Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, tooth thickness measurement using constant chord method, addendum comparator method and base tangent method, measurement of pitch, concentricity, run out, and involute profile. Gear roll tester for composite error.

Advances in metrology:

Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines- constructional features, applications.

MODULE 4**Measurement systems and basic concepts of measurement methods:**

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs.

MODULE 5**Force, Torque and Pressure Measurement:**

Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.

Measurement of strain and temperature:

Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors.

Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.

Course outcomes:

- **Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.**
- **Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.**
- **Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design.**
- **Understand the principle of Johnson Mikrokator, sigma comparator, dial indicator, LVDT, back pressure gauges, Sorex comparators and Zeiss Ultra Optimeter.**
- **Describe measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 – wire, 3 – wire methods, screw thread gauges and tool maker's microscope.**

- Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile.
- Understand laser interferometers and Coordinate measuring machines.
- Explain measurement systems, transducers, intermediate modifying devices and terminating devices.
- Describe functioning of force, torque, pressure, strain and temperature measuring devices.

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Instrumentation, Measurement and Analysis**, B C Nakra, K K Chaudhry, 4th Edition, McGraw –Hill
3. **Engineering Metrology**, R.K. Jain, Khanna Publishers, Delhi, 2009.

REFERENCE BOOKS

1. **Engineering Metrology and Measurements**, Bentley, Pearson Education.
2. **Theory and Design for Mechanical Measurements, III edition**, Richard S Figliola, Donald E Beasley, WILEY India Publishers.
3. **Engineering Metrology**, Gupta I.C., Dhanpat Rai Publications.
4. **Deoblin's Measurement system**, Ernest Deoblin, Dhanesh manick, McGraw–Hill.
5. **Engineering Metrology and Measurements**, N.V.Raghavendra and L.Krishnamurthy, Oxford University Press.

MATERIALS TESTING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37 A / 47A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To learn the concept of the preparation of samples to perform characterization such as microstructure, volume fraction of phases and grain size.
2. To understand mechanical behavior of various engineering materials by conducting standard tests.
3. To learn material failure modes and the different loads causing failure.
4. To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment, surface treatment etc.

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials.
To report microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel.
Metallographic specimens of heat treated components to be supplied and students should report microstructures of furnace cooled, water cooled, air cooled, tempered steel.
Students should be able to distinguish the phase changes in a heat treated specimen compared to untreated specimen.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. To study the defects of Cast and Welded components using Non-destructive tests like:
 - a) Ultrasonic flaw detection
 - b) Magnetic crack detection
 - c) Dye penetration testing.

PART B

1. Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine
2. Torsion Test on steel bar.
3. Bending Test on steel and wood specimens.
4. Izod and Charpy Tests on Mild steel and C.I Specimen.
5. To study the wear characteristics of ferrous and non-ferrous materials under different parameters.

6. Fatigue Test (demonstration only).

Course outcomes:

- ▯ **Acquire experimentation skills in the field of material testing.**
- ▯ **Develop theoretical understanding of the mechanical properties of materials by performing experiments.**
- ▯ **Apply the knowledge to analyze a material failure and determine the failure inducing agent/s.**
- ▯ **Apply the knowledge of testing methods in related areas.**
- ▯ **Know how to improve structure/behavior of materials for various industrial applications.**

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
Viva -Voice:	20 Marks
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Total :	100 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LAB
B.E, IV Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL37B / 47B	CIE Marks	40
Number of Lecture Hours/Week	03 (1Hour instruction + 2 hours Laboratory)	SEE Marks	60
RBT Levels	L1 , L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

PART A :MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer OR
 - b) Drill tool Dynamometer.
5. Measurements of Screw thread Parameters using two wire or Three-wire methods.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Course outcomes:

- ☐ To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer.
- ☐ To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set.
- ☐ To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
- ☐ To measure cutting tool forces using Lathe/Drill tool dynamometer.
- ☐ To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer.
- ☐ To measure surface roughness using Tally Surf/ Mechanical Comparator.

Scheme of Examination:

ONE question from part -A:	30 Marks
ONE question from part -B:	50 Marks
<u>Viva -Voice:</u>	<u>20 Marks</u>
Total :	100 Marks

FOUNDRY AND FORGING LAB
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38A / 48A	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

- ☐ To provide an insight into different sand preparation and foundry equipment.
- ☐ To provide an insight into different forging tools and equipment.
- ☐ To provide training to students to enhance their practical skills.
- ☐ To practically demonstrate precautions to be taken during casting and hot working.
- ☐ To develop team qualities and ethical principles.

PART-A

1. Testing of Molding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Sieve Analysis to find Grain Fineness Number(GFN) of Base Sand
4. Clay content determination in Base Sand.

PART-B

2. Foundry Practice

1. Use of foundry tools and other equipment's.
2. Preparation of molding sand mixture.
3. Preparation of green sand molds using two molding boxes kept ready for pouring.
 - ☐ Using patterns (Single piece pattern and Split pattern)
 - ☐ Without patterns.
 - ☐ Incorporating core in the mold. (Core boxes).
 - ☐ Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations :

Use of forging tools and other equipment's

- Calculation of length of the raw material required to prepare the model considering scale losses.
- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- ☐ Demonstration of forging model using Power Hammer.

Course outcomes:

Students will be able to

- ▯ **Demonstrate various skills of sand preparation, molding.**
- ▯ **Demonstrate various skills of forging operations.**
- ▯ **Work as a team keeping up ethical principles.**

Scheme of Examination:

One question is to be set from Part-A 30

Marks

One question is to be set from either Part-B or Part-C50 Marks

Viva – Voce 20

Total Marks100

MACHINE SHOP
B.E, III Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL38B / 48B	CIE Marks	40
Number of Hours/Week	03 (1 Hour Instruction + 2 Hours Laboratory)	SEE Marks	60
Total Hours	50	Exam Hours	03

Credits – 02

Course Objectives:

- ▯ To provide an insight to different machine tools, accessories and attachments
- ▯ To train students into machining operations to enrich their practical skills
- ▯ To inculcate team qualities and expose students to shop floor activities
- ▯ To educate students about ethical , environmental and safety standards

PART-A:

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART-B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper
 Cutting of Gear Teeth using Milling Machine

PART C

For demonstration

Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder. Demonstration of surface milling /slot milling

Course outcomes:

- ▯ Perform turning , facing , knurling , thread cutting, tapering , eccentric turning and allied operations, keyways / slots , grooves etc using shaper
- ▯ Perform gear tooth cutting using milling machine
- ▯ Understand the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder, Surface Milling/Slot Milling
- ▯ Demonstrate precautions and safety norms followed in Machine Shop
- ▯ Exhibit interpersonal skills towards working in a team

Scheme of Examination:

One Model from Part – A	50 Marks
One Model from Part – B	30 Marks
Viva Voce	20 Marks
Total 100 Marks	

MANAGEMENT AND ENGINEERING ECONOMICS
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME51	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- Examine the meaning, importance, nature of management, its difference between management and administration and role of managers in management.
- Examine the meaning characteristics principles and process of organizing.
- Describe effective communication process, its importance, types and purpose for running an organization.
- Explain the importance of engineering economics, Law of demand and supply in engineering decision making.
- Describe various interest rate factors and implement the same for economic decision making.
- Examine different economic analysis methods-NPW, EAW, IRR, FW for decision making.
- Discuss different component of costs and methods of cost estimation.
- Explain depreciation, different methods of computing depreciation.
- Discuss taxation concepts-income tax and corporate taxes.

Module - 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought-early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning -steps in planning & planning premises - Hierarchy of plans.

Module - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)

Module - 3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems

Module - 4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems

Module - 5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.

Course outcomes:

On completion of this subject students will be able to

1. Explain the development of management and the role it plays at different levels in an organization.
2. Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
3. Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.
4. Understand engineering economics demand supply and its importance in economics decision making and problem solving.
5. Calculate present worth, annual worth and IRR for different alternatives in economic decision making.
6. Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.

TEXT BOOKS:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY
B.E, VSemester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME52	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- 1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.**
- 2. Analyze the mechanisms for static and dynamic equilibrium.**
- 3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.**
- 4. Analyze the balancing of rotating and reciprocating masses, governors and gyroscopes.**
- 5. To understand vibrations characteristics of single degree of freedom systems.**
- 6. Characterize the single degree freedom systems subjected to free and forced vibrations with and without damping.**

Module - 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

Module - 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

Module - 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

Module - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

Module - 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

Course outcomes:

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

TEXT BOOKS:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K. Grover, Nem Chand and Bros.

REFERENCE BOOKS

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES
B.E, VSemester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME53	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.**
- ▯ **Explain the working principles of turbomachines and apply it to various types of machines**
- ▯ **It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.**

Module - 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process

Module - 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

Module - 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

Module - 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and Propeller turbines** - velocity triangles, design parameters. Problems.

Module - 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

Course outcomes:

- ▯ **Able to give precise definition of turbomachinery**
- ▯ **Identify various types of turbo machinery**
- ▯ **Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines**
- ▯ **Understand the principle of operation of pumps, fans, compressors and turbines.**
- ▯ **Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)**
- ▯ **Analyze the performance of turbo machinery.**

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbo Machines ,B.U.Pai , 1st Editions, Wiley India Pvt, Ltd.
3. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).
3. Text Book of Turbo machines, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME54	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module - 1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.
 Static Stresses: Static loads. Normal, Bending, Shear and Combined stresses. Theories of failure. Stress concentration and determination of stress concentration factor.

Module - 2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.
 Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

Module - 3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads. Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

Module - 5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

Course outcomes:

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

TEXT BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME551	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- 1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems**
- 2. Understand the working principles and applications of different types of refrigeration systems**
- 3. Study the working of air conditioning systems and their applications**
- 4. Identify the performance parameters and their relations of an air conditioning system**

Module - 1

Introduction to Refrigeration –Basic Definitions, Heat pump and Refrigerating Machine, Best Refrigeration Cycle:The Carnot Principle, Gas as a Refrigerant in Reversed Carnot Cycle,Limitations of Reversed Carnot Cycle, Reversed Brayton or Bell Coleman Cycle, Application to Aircraft Refrigeration, Simple Numerical problems.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing units.

Module - 2

Vapor Compression Refrigeration System(VCRS): Modifications in Reversed Carnot Cycle with Vapor as a refrigerant, Vapor Compression Cycle, Ewing’s Construction, Actual Vapor Compression Cycle, Effect of Operating Conditions. Simple Numerical problems.

Multistage or Compound Compression, Multi-evaporator systems, Cascade Systems, – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

Module - 3

Vapor Absorption Refrigeration Systems: Simple Vapor – Absorption System, Maximum Coefficient of Performance of a Heat Operated Refrigerating Machine, Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Modifications to Simple Vapor-Absorption, Electrolux Refrigerator.

Other types of Refrigeration systems: (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration,(iii) pulse tube refrigeration, (iv)thermo acoustic refrigeration systems

Module - 4

Refrigerants:Primary and Secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants, Selection of a Refrigerant, Ozone Depletion Potential and Global Warming Potential of CFC Refrigerants. Thermodynamic requirements, Comparison between different refrigerants, Substitutes for CFC refrigerants, Secondary Refrigerants.

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

Module - 5

Air-Conditioning: Basic Processes in Conditioning of Air, Psychrometric Processes in Air-Conditioning Equipment, Simple Air-Conditioning /system and State and Mass Rate of Supply Air, Summer Air Conditioning, Winter Air Conditioning.

Loading Calculation and Applied Psychometrics : Preliminary Considerations, Internal Heat Gains, System Heat Gains, Break-up of Ventilation Load and Effective Sensible Heat Factor, Cooling Load Estimate. Psychrometric Calculations for Cooling, Selection of Air-Conditioning Apparatus for Cooling and Dehumidification, Building Requirements and Energy Conservation in Air Conditioned Buildings.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

Course outcomes:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapor compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapor absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS:

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

NON TRADITIONAL MACHINING
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME554	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8Hours per Module)	Exam Hours	03

Credits – 03

Module - 1

INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

Module - 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

Module - 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

Module - 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

Module - 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

Course outcomes:

- 1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.**
- 2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.**
- 3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.**
- 4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.**
- 5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.**

TEXT BOOKS:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

REFERENCE BOOKS

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME562	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8Hours per Module)	Exam Hours	03

Credits – 03

Course Objective:

1. **Understand energy scenario, energy sources and their utilization**
2. **Learn about methods of energy storage, energy management and economic analysis**
3. **Have proper awareness about environment and eco system.**
4. **Understand the environment pollution along with social issues and acts.**

Module - 1

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment..

Module - 2

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems
Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing
Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries
Economic Analysis: Scope, Characterization of an Investment Project

Module - 3

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.
Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession.

Module - 4

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards , Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies.

Module - 5

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act,

Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

Course outcomes:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S Rao, New Age International, 2006, reprint 2015, 2nd edition.
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

FLUID MECHANICS & MACHINERY LAB
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL57	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART B

1. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines

2. Performance hydraulic Pumps
 - a. Single stage and Multi stage centrifugal pumps
 - b. Reciprocating pump
3. Performance test on a two stage Reciprocating Air Compressor
4. Performance test on an Air Blower

PART C(Optional)

1. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
2. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course outcomes:

- ☐ **Perform experiments to determine the coefficient of discharge of flow measuring devices.**
- ☐ **Conduct experiments on hydraulic turbines and pumps to draw characteristics.**
- ☐ **Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.**
- ☐ **Determine the energy flow pattern through the hydraulic turbines and pumps**
- ☐ **Exhibit his competency towards preventive maintenance of hydraulic machines**
- ☐

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. JagdishLal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 50 Marks
 ONE question from part -B: 30 Marks
 Viva –Voice : 20 Marks
 Total: 100 Marks

ENERGY LAB
B.E, V Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL58	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
Total hours	50	Exam Hours	03

Credits – 02

Course Objectives:

- 1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices**
- 2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.**
- 3. Exhaust emissions of I C Engines will be measured and compared with the standards.**

PART A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART B

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
2. Measurements of Exhaust Emissions of Petrol engine.
3. Measurements of Exhaust Emissions of Diesel engine.

4. Demonstration of p , pV plots using Computerized IC engine test rig

PART C(Optional)

1. Visit to Automobile Industry/service stations.
2. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course outcomes:

- ☐ **Perform experiments to determine the properties of fuels and oils.**
- ☐ **Conduct experiments on engines and draw characteristics.**
- ☐ **Test basic performance parameters of I.C. Engine and implement the knowledge in industry.**
- ☐ **Identify exhaust emission, factors affecting them and report the remedies.**
- ☐ **Determine the energy flow pattern through the I C Engine**
- ☐ **Exhibit his competency towards preventive maintenance of IC engines.**

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) –USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai & sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 50 Marks
ONE question from part -B: 30 Marks
Viva –Voice : 20 Marks
Total: 100 Marks

FINITE ELEMENT ANALYSIS
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME61	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **To learn basic principles of finite element analysis procedure.**
- **To learn the theory and characteristics of finite elements that represent engineering structures.**
- **To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.**

Module - 1

Introduction to Finite Element Method: General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems. Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretization process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

Module - 2

One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for 1D, 2D elements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA8), 2D iso-parametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Fore terms: Body force, traction force and point loads,
Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses

Module - 3

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.
Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

Module - 4

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Module - 5

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.
Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

- 1. Understand the concepts behind formulation methods in FEM.**
- 2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.**
- 3. Develop element characteristic equation and generation of global equation.**
- 4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axisymmetric and dynamic problems and solve them displacements, stress and strains induced.**

TEXT BOOKS:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergamon Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

REFERENCE BOOKS

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME62	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▯ **To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.**
- ▯ **To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.**
- ▯ **To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.**
- ▯ **To expose students to computer aided process planning, material requirement planning, capacity planning etc.**
- ▯ **To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.**
- ▯ **To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.**

Module - 1

Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems.

Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems.

Module - 2

CAD and Computer Graphics Software: The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

Module - 3

Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

Line Balancing: Line balancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method.

Module - 4

Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: Material handling, processing and assembly and inspection.

Module - 5

Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing.

Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems.

Course outcomes:

- ☐ Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts.
- ☐ Solve simple problems of transformations of entities on computer screen.
- ☐ Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
- ☐ Analyze the automated flow lines to reduce down time and enhance productivity.
- ☐ Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
- ☐ Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

TEXT BOOKS:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

REFERENCE BOOKS

1. "CAD/CAM" by Ibrahim Zeid, Tata McGraw Hill.
2. "Principles of Computer Integrated Manufacturing", S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.
3. "Work Systems And The Methods, Measurement And Management of Work", Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. "Computer Automation in Manufacturing", Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. "Introduction to Robotics: Mechanics And Control", Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. "**Understanding Additive Manufacturing**", Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME63	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▢ Study the modes of heat transfer.
- ▢ Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- ▢ Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- ▢ Study the basic principles of heat exchanger analysis and thermal design.
- ▢ Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module - 1

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.
 Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel.

Module - 2

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications
 Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Numerical Problems, Heisler and Grober charts.
 Introduction to Numerical analysis of Heat conduction

Module - 3

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.
 Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

Module - 4

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield.

Module - 5

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers. Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

Course outcomes:

- ☐ **Understand the basic modes of heat transfer.**
- ☐ **Compute temperature distribution in steady-state and unsteady-state heat conduction**
- ☐ **Understand and interpret heat transfer through extended surfaces.**
- ☐ **Interpret and compute forced and free convective heat transfer.**
- ☐ **Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.**
- ☐ **Design heat exchangers using LMTD and NTU methods.**

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.
3. J P Holman, Souvik Bhattacharyya, 10th Edition, McGraw Hill Education Private Ltd.,

REFERENCE BOOKS

1. Heat and mass transfer, Kurt C, Rolle, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sayma, Bookboon.com

DESIGN OF MACHINE ELEMENTS II
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME64	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- ▢ To understand various elements involved in a mechanical system.
- ▢ To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
- ▢ To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
- ▢ To design completely a mechanical system integrating machine elements.
- ▢ To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

Module - 1

Curved Beams:Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.
Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

Module - 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes:Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive:Types of power transmission chains, modes of failure for chain, and lubrication of chains (Only theoretical treatment)

Springs:Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs; springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs, equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

Module - 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

Module - 4

Worm Gears: Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches: Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes: Types of Brakes, Block and Band brakes, self-locking of brakes, and heat generation in brakes.

Module - 5

Lubrication and Bearings: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated. Numerical examples on hydrodynamic journal and thrust bearing design.

Anti-friction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

Course outcomes:

- Apply engineering design tools to product design.
- Design mechanical systems involving springs, belts and pulleys.
- Design different types of gears and simple gear boxes for different applications.
- Design brakes and clutches.
- Design hydrodynamic bearings for different applications.
- Select Anti friction bearings for different applications using the manufacturers, catalogue.
- Develop proficiency to generate production drawings using CAD software.
- Become good design engineers through learning the art of working in a team with morality and ethics.

TEXT BOOKS:

[1] Richard G. Budynas, and J. Keith Nisbett, "Shigley's Mechanical Engineering Design", McGraw-Hill Education, 10th Edition, 2015.

[2] Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, Wiley student edition, 2007.

[3] V. B. Bhandari, "Design of Machine Elements", 4th Ed., Tata Mcgraw Hill, 2016.

REFERENCE BOOKS

References:

- [1] Robert L. Norton “Machine Design- an integrated approach”, Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E “Design and Machine Elements”, Pearson Education, 8th edition,2006.
- [3] Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
- [4] Hall, Holowenko, Laughlin (Schaum’s Outline Series), “Machine design” adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.
- [5] G. M. Maithra and L.V.Prasad, “Hand book of Mechanical Design”, Tata McGraw Hill, 2nd edition,2004

METAL FORMING
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME653	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ **To acquaint with the basic knowledge on fundamentals of metal forming processes**
- ▯ **To study various metal forming processes**
- ▯ **Understanding plastic deformation during forming processes**

Module - 1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties.

Module - 2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metal working, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems.

Module - 3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems.

Module - 4

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems

Module - 5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

Course outcomes:

- ▯ **Able to understand the concept of different metal forming process.**
- ▯ **Able to approach metal forming processes both analytically and numerically**
- ▯ **Able to design metal forming processes**
- ▯ **Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.**

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuvanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K, Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

AUTOMOBILE ENGINEERING
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME655	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- ▯ The layout and arrangement of principal parts of an automobile
- ▯ The working of transmission and brake systems
- ▯ The operation and working of steering and suspension systems
- ▯ To know the Injection system and its advancements
- ▯ To know the automobile emissions and its effects on environment

Module - 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system.

Module - 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical

Module - 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system.

Module - 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

Module - 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, controlling crankcase emissions, controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

Course outcomes:

- ☐ To identify the different parts of an automobile and its working
- ☐ To understand the working of transmission and braking systems
- ☐ To comprehend the working of steering and suspension systems
- ☐ To learn various types of fuels and injection systems
- ☐ To know the cause of automobile emissions, its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, SatyaPrakashan,(4th Edition) 1984.

Maintenance Engineering
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME663	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course objectives:

The course is intended to provide basic concepts of maintenance engineering to engineering students with following aspects:

- To acquire basic understanding of Maintenance systems
- To develop an understanding of the principles of Preventive Maintenance & Predictive Maintenance
- Provides a methodology for reliability & probability concepts applied to maintenance engineering
- The students will concept and procedures for Condition Monitoring in Mechanical and Electrical systems along with the analysis and processing techniques for machine fault identification

Module – 1

Maintenance systems: Maintenance objectives and scopes; Maintenance strategies & organizations; Maintenance works; life cycle costs Preventive Maintenance: Principles of preventive maintenance, procedures & selection; Preventive Maintenance planning, scheduling and control; Forms & resources; Maintenance work measurement; Modeling and analysis techniques in PM and inspections; Predictive maintenance.

Computerized Maintenance Management systems: Benefits and applications; Work order systems & plant registers; Maintenance reports, analysis and monitoring; Introduction to commercial packages Equipment maintenance: Installation, commissioning and testing of plant equipment, checking for alignment, lubrication and lubrication schedule; maintenance of typical rotating and process equipment systems like turbines, pumps and fans, centrifuges, heat exchangers, boilers and pressure vessels etc.

Module – 2

Reliability & probability Concepts: Basic concepts of probability theory and distributions, definition of reliability, failure probability, reliability and hazard rate function, MTBF and MTTR, System reliability, series and parallel system, redundancy.

Module – 3

Reliability Centered Maintenance: principles of RCM, Benefits of RCM, application of RCM Step-by-step procedure in conducting RCM analysis. The Plant Register. Functions and Failures. Failure mode and effect analysis (FMEA). Failure consequences. Maintenance and decision making. Actuarial analysis and Failure data. Perspective loops. Default action. The RCM Decision diagram. The nature of Failure and Technical history.

Module – 4

Total Productive Maintenance: Goals of TPM and methodology, TPM improvement plan & procedures. The modern role of care and asset management through TPM, the use of TPM concepts consisting of Pareto ABC analysis, Fishbone diagrams, OEE and 5S. Fault analysis.

Condition Monitoring:**Measurable phenomena from different Plant Items:**

Measurable phenomena associated with degradation from a range of plant items including motors/generators, transformers, cables, bushings, connectors, capacitors and circuit breakers.

Module - 5**Fault diagnosis of Rotational Machines:**

Unbalance, shaft and coupling misalignments, bent shafts, gear and bearing wear, oil whirls and shaft eccentricity.

Measurement Strategies and Techniques:

A wide range of strategies and associated technologies will be discussed including light emission (photo multipliers, fiber optic techniques etc.), heat emissions (IR, cameras, direct temperature measurement, etc.), electrical charges (tan d, electrical particle discharge, etc.), force, power and vibration.

Data Processing and Analysis:

For each of the approaches, options with respect to data processing and analysis will be discussed including digital signal processing and computational techniques. Close attention will be paid through examples of the cost benefits and the reliability which can be placed on data with respect to formulating a view on the condition of a give item of plant.

Course outcomes:**On completion of this subject students will be able to:**

- 1. Understand maintenance objectives and evaluate various maintenance strategies for process plant application, Develop necessary planning and scheduling and control of preventive maintenance activities.**
- 2. Evaluate reliability of a simple plant component and system.**
- 3. Understand and apply the advanced concepts such as RCM and advantages for a company employing them**
- 4. Understand and apply the advanced concepts such as TPM and advantages for a company employing**
- 5. Apply the principles of condition monitoring systems.**
- 6. Apply the mechanical condition monitoring techniques and analyze the data used in condition monitoring**

TEXT BOOKS:

1. Practical machinery Vibration Analysis & Predictive Maintenance, C. Scheffer and P. Girdhar,, IDC technologies, 2004.
2. Introduction to Machinery Analysis and Monitoring, John S. Mitchell, PennWell Books, 1993.
3. Machinery Vibration, Measurement and Analysis, Victor Wowk, Mc Craw Hill, 1991

REFERENCE BOOKS

1. Handbook of Condition Monitoring, B.K.N. Rao, 1996
2. Reliability Engineering, Srinath L S,
3. Maintenance Replacement and Reliability, Jardine AKS,
4. Practical reliability engineering, Oconnor, Patrick D T
5. , Reliability and Maintainability Engineering, Charles E Ebeling
6. Introduction to Reliability Engineering Lewis E,

TOTAL QUALITY MANAGEMENT
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME664	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course objectives:

- 1. Understand various approaches to TQM**
- 2. Understand the characteristics of quality leader and his role.**
- 3. Develop feedback and suggestion systems for quality management.**
- 4. Enhance the knowledge in Tools and Techniques of quality management**

Module – 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements

Module – 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

Module – 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

Module – 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control: Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

Course outcomes:

1. Explain the various approaches of TQM
2. Infer the customer perception of quality
3. Analyze customer needs and perceptions to design feedback systems.
4. Apply statistical tools for continuous improvement of systems
5. Apply the tools and technique for effective implementation of TQM.

TEXT BOOKS:

- Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS

1. Managing for Quality and Performance Excellence by James R.Evans and William M Lindsay, 9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Heat Transfer Lab
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL67	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course objectives:

- ▯ **The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.**
- ▯ **This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.**

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Stefan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.

7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course outcomes:

1. **Perform experiments to determine the thermal conductivity of a metal rod**
2. **Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.**
3. **Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin**
4. **Determine surface emissivity of a test plate**
5. **Estimate performance of a refrigerator and effectiveness of fin**
6. **Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.**

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 50 Marks

ONE question from part -B: 30 Marks

Viva –Voice :20 Marks

Total: 100 Marks

Modeling and Analysis Lab (FEA)
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL68	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits – 02

Course objectives:

- ▯ **To acquire basic understanding of Modeling and Analysis software**
- ▯ **To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.**
- ▯ **To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.**

PART – A

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load, UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART – B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination
 - b) Bar subjected to forcing function
 - c) Fixed – fixed beam subjected to forcing function

PART – C

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course outcomes:

- ▯ **Demonstrate the basic features of an analysis package.**
- ▯ **Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.**
- ▯ **Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.**
- ▯ **Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.**
- ▯ **Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.**

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 40Marks (10 Write up +30)

One Question from Part B - 40 Marks (10 Write up +30)

Viva-Voce - 20 Marks

Total 100 Marks

ENERGY ENGINEERING
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME71	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **Understand energy scenario, energy sources and their utilization**
- **Learn about energy conversion methods and their analysis**
- **Study the principles of renewable energy conversion systems**
- **Understand the concept of green energy and zero energy.**

Module - 1

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

Module - 2

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.
Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

Module - 3

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

Module - 4

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal land vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, Limitations.

Module - 5

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts .

Course outcomes:

1. Summarize the basic concepts of thermal energy systems,
2. Identify renewable energy sources and their utilization.
3. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
4. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

FLUID POWER SYSTEMS
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME72	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- **To provide an insight into the capabilities of hydraulic and pneumatic fluid power.**
- **To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.**
- **To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.**
- **Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.**
- **To familiarize with logic controls and troubleshooting**

Module - 1

Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

Module - 2

Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

Module - 3

Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design: Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application, hydraulic cylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for

force multiplication; speed control of hydraulic cylinder- metering in, metering out and bleed off circuits. Pilot pressure operated circuits. Hydraulic circuit examples with accumulator.

Module - 4

Pneumatic power systems

Introduction to Pneumatic systems: Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications.

Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

Module - 5

Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

Course outcomes:

1. **Identify and analyse the functional requirements of a fluid power transmission system for a given application.**
2. **Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.**
3. **Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.**
4. **Select and size the different components of the circuit.**
5. **Develop a comprehensive circuit diagram by integrating the components selected for the given application.**

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw Hill, 2002.
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol II, I and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

CONTROL ENGINEERING

B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME73	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- Modeling of mechanical, hydraulic, pneumatic and electrical systems.
- Representation of system elements by blocks and its reduction
- Transient and steady state response analysis of a system.
- Frequency response analysis using polar plot.
- Frequency response analysis using bode plot.
- Analysis of system using root locus plots.
- Different system compensators and variable characteristics of linear systems.

Module - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

Module - 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

Module - 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation

Module - 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins

Module - 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

Course outcomes:

1. **Recognize control system and its types , control actions**
2. **Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, ElectroMechanical)**
3. **Calculate the gain of the system using block diagram and signal flow graph**
4. **Illustrate the response of 1st and 2nd order systems**
5. **Determine the stability of transfer functions in complex domain and frequency domain**
6. **Employ state equations to study the controllability and observability**

TEXT BOOKS:

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. “Control systems Principles and Design”, M.Gopal, 3rd Edition, TMH, 2000.

REFERENCE BOOKS:

3. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
4. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
5. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Ninth edition
6. J.Nagrath and M.Gopal, ” Control System Engineering”, New Age International Publishers, 5th Edition, 2007
7. “Feedback control systems”, Schaum’s series, 2001.
8. System dynamics and control, Eronini-Umez, Thomas Asia Pte Ltd., Singapore 2002.

TRIBOLOGY
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME742	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

Credits –03

Course Objectives:

- ▯ **To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.**
- ▯ **To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.**
- ▯ **To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.**
- ▯ **To expose the students to the factors influencing the selection of bearing materials for different sliding applications.**
- ▯ **To introduce the concepts of surface engineering and its importance in tribology.**

Module - 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

Module - 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

Module - 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

Module - 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

Module - 5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapour phase processes.

Selection of coating for wear and corrosion resistance.

Course outcomes:

1. Understand the fundamentals of tribology and associated parameters.
2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
3. Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
4. Select proper bearing materials and lubricants for a given tribological application.
5. Apply the principles of surface engineering for different applications of tribology.

TEXT BOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCE BOOKS

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME753	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits –03

Course Objective:

- Understand the evolution and development of Mechatronics as a discipline.
- Substantiate the need for interdisciplinary study in technology education.
- Understand the applications of microprocessors in various systems and to know the functions of each element
- Demonstrate the integration philosophy in view of Mechatronics technology

Module - 1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors.

Module - 2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor.

Module - 3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot.

Module - 4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors.

Module - 5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve, solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

Course outcomes:

On completion of this subject, students will be able to:

- 1. Illustrate various components of Mechatronics systems.**
- 2. Assess various control systems used in automation.**
- 3. Develop mechanical, hydraulic, pneumatic and electrical control systems.**

TEXT BOOKS:

1. Nitaigour Premchand Mahalik, Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1st Edition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W. Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1st Edition, 2005 ISBN.No. 81-7758-284-4.

REFERENCE BOOKS

1. Mechatronics by HMT Ltd. – Tata McGraw Hill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power, Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

DESIGN LABORATORY
B.E, VII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MEL76	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
RBT Levels	L1, L2, L3	Exam Hours	03

Credits –02

Course Objective:

- To understand the natural frequency, logarithmic decrement, damping ratio and damping.
- To understand the balancing of rotating masses.
- To understand the concept of the critical speed of a rotating shaft.
- To understand the concept of stress concentration using Photo elasticity.
- To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

Course outcomes:

On completion of this subject, students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.

5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

REFERENCE BOOKS

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

Scheme of Examination:

One question from Part A:	50 Marks
One question from part B:	30 Marks
Viva- Voce:	20Marks
<hr/> Total:	<hr/> 100 Marks

COMPUTER INTEGRATED MANUFACTURING LAB B.E, VII Semester, Mechanical Engineering [As per Choice Based Credit System (CBCS) scheme]			
Course Code	17MEL77	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
Total Hours	40	Exam Hours	03
Credits –02			

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes
CLO2	To educate the students on the usage of CAM packages and cut part on virtual CNC machine simulator.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master-CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Enter program, take tool offsets, cut part in single block and auto mode, measure the virtual part on screen in the virtual CNC machine simulator, for standard CNC control systems FANUC, FAGOR, HAAS and SINUMERIK.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time; set up and cut part on.
CLO6	Understand & write programs for Robot control; understand the operating principles of hydraulics, pneumatics and electro pneumatic systems.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	17MEP78	2	0-3-0	100	-	-

OPERATIONS RESEARCH
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME81	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

Module - 1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. SolutionstoLPP by graphical method(Two Variables).

Module - 2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

Module - 3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution(MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Module - 4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashingofnetworks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models.

Module - 5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method.

Course outcomes:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD. Publications, New Delhi –2007
2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
3. Introduction to Operations Research, Lieberman/Nag/Basu, 9th Edition, McGraw Hill Education Pvt.Ltd.,

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill

ADDITIVE MANUFACTURING
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME82	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

- 1. Understand the additive manufacturing process, polymerization and powder metallurgy process**
- 2. Understand characterisation techniques in additive manufacturing.**
- 3. Acquire knowledge on CNC and Automation.**

Module - 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries.

Module - 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, and Triacs. Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

Module - 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] **Polymer Processing:** Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques

General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM

Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.

Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization

Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques.

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.

Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components

Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.

Module - 4

NANO MATERIALS & CHARACTERIZATION TECHNIQUES:

Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology

Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC).

Optical Microscopy - principles, Imaging Modes, Applications, Limitations.

Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. **Transmission Electron Microscopy (TEM)** - principles, Imaging Modes, Applications, Limitations. **X-Ray Diffraction (XRD)** - principles, Imaging Modes, Applications, Limitations. **Scanning Probe Microscopy (SPM)** - principles, Imaging Modes, Applications, Limitations. **Atomic Force Microscopy (AFM)** - basic principles, instrumentation, operational modes, Applications, Limitations. **Electron Probe Micro Analyzer (EPMA)** - Introduction, Sample preparation, Working procedure, Applications, Limitations.

Module - 5

MANUFACTURING CONTROL AND AUTOMATION

CNC technology - An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC **Part programming:** CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)

Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity

Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.

Course outcomes:

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programming and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Interscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS
B.E, VIII Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME832	CIE Marks	40
Number of Lecture Hours/Week	03	SEE Marks	60
Total Number of Lecture Hours	40(8 Hours per Module)	Exam Hours	03

Credits – 03

Course Objectives:

- 4. To understand the measurement of strain using electrical strain gauges.**
- 5. To analyze stress and strains induced mechanical systems using electrical strain gauges.**
- 6. To understand the photo elastic techniques to characterize the elastic behavior of solids.**
- 7. To understand elastic behavior of solid bodies using coating techniques.**
- 8. To apply the holography methods to measure stress and strains.**

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. General consideration in data analysis.

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

Module - 2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

Module - 3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials.

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity.

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's Stress separation techniques: Oblique incidence.

Module - 5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings and its applications.

Moire Methods: Moire fringes produced by mechanical interference. Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements. Applications and advantages

Course outcomes:

1. **Explain and the elastic behavior of solid bodies.**
2. **Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.**
3. **Understand the experimental methods of determining stresses and strains induced.**
4. **Apply the coating techniques to determine the stresses and strains.**

TEXT BOOKS:

1. **"Experimental Stress Analysis"**, Dally and Riley, McGraw Hill.
2. **"Experimental Stress Analysis"**. Sadhu Singh, Khanna publisher.

REFERENCE BOOKS

1. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.
2. **"Photoelasticity Vol I and Vol II**, M.M.Frocht, John Wiley & sons.
3. **"Photo Elastic Stress Analysis"**, Kuske, Albrecht & Robertson John Wiley & Sons.
4. **Motion Measurement and Stress Analysis Dave and Adams**
5. **Holman, "Experimental Methods for Engineers"** Tata McGraw Hill Companies, 7th Edition, New York, 2007

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	17ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	17MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	17MES86	1	0-4-0	100	-	-

B.E. Mechanical Engineering

V SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME51	Management and Engineering Economics	3	2	0	03	80	20	100	4
2	15ME52	Dynamics of Machinery	3	2	0	03	80	20	100	4
3	15ME53	Turbo Machines	3	2	0	03	80	20	100	4
4	15ME54	Design of Machine Elements - I	3	2	0	03	80	20	100	4
5	15ME55X	Professional Elective-I	3	0	0	03	80	20	100	3
6	15ME56X	Open Elective-I	3	0	0	03	80	20	100	3
7	15MEL57	Fluid Mechanics & Machinery Lab	1	0	2	03	80	20	100	2
8	15MEL58	Energy Lab	1	0	2	03	80	20	100	2
TOTAL			21	06	04		640	160	800	26

Professional Elective-I		Open Elective-I	
15ME551	Refrigeration and Air-conditioning	15ME562	Energy and Environment
15ME554	Non Traditional Machining		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

MANAGEMENT AND ENGINEERING ECONOMICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Management And Engineering Economics	15ME51	04	3-2-0	80	20	3Hrs

MODULE – 1

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought- early management approaches – Modern management approaches.

Planning: Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans. **10 Hours**

MODULE - 2

Organizing And Staffing: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief) **10 Hours**

MODULE -3

Introduction: Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity.

Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems **10 Hours**

MODULE -4

Present, future and annual worth and rate of returns: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinite lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems **10 Hours**

MODULE -5

Costing and depreciation: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems. **10 Hours**

Course outcomes

On completion of this subject students will be able to

1. Understand needs, functions, roles, scope and evolution of Management
2. Understand importance, purpose of Planning and hierarchy of planning and also analyze its types
3. Discuss Decision making, Organizing, Staffing, Directing and Controlling
4. Select the best economic model from various available alternatives
5. Understand various interest rate methods and implement the suitable one.
6. Estimate various depreciation values of commodities
7. Prepare the project reports effectively.

TEXT BOOKS

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI, 2002

REFERENCE BOOKS

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

DYNAMICS OF MACHINERY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Dynamics of Machinery	15ME52	04	3-2-0	80	20	3Hrs

Course Objectives

1. To gain the knowledge static and dynamic equilibrium conditions of mechanisms subjected forces and couple, with and without friction.
2. Analyse the mechanisms for static and dynamic equilibrium.
3. To understand the balancing principles of rotating and reciprocating masses, governors and gyroscopes.
4. Analyse the balancing of rotating and reciprocating masses, governors and gyroscopes.
5. To understand vibrations characteristics of single degree of freedom systems.
6. Characterise the single degree freedom systems subjected to free and forced vibrations with and without damping.

MODULE 1

Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, Static force analysis of four bar mechanism and Slider-crank mechanism with and without friction.

Dynamic force Analysis: D'Alembert's principle, Inertia force, Inertia torque. Dynamic force analysis of four-bar mechanism and Slider crank mechanism without friction, numerical problems.

10 Hours

MODULE 2

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, Single cylinder engine, balancing in multi cylinder-inline engine (primary and secondary forces), numerical problems.

10 Hours

MODULE 3

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems.

10 Hours

MODULE - 4

Introduction & Undamped free Vibrations (Single Degree of Freedom)

Types of vibrations, Definitions, Simple Harmonic Motion (SHM), Work done by harmonic force, Principle of super position applied to SHM. Methods of analysis – (Newton's, Energy & Rayleigh's methods). Derivations for spring mass systems, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and problems.

10 Hours

MODULE – 5

Damped free Vibrations (Single Degree of Freedom)

Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and numerical problems.

Forced Vibrations (Single Degree of Freedom):

Analysis of forced vibration with constant harmonic excitation, Magnification factor (M.F.), Vibration isolation - Transmissibility ratio, Excitation of support (absolute and relative), Numerical problems.

10 Hours

Course outcomes

On completing the course the student will be able to

1. Determine the forces and couples for static and dynamic conditions of four bar and slider crank mechanisms to keep the system in equilibrium.
2. Determine magnitude and angular position of balancing masses under static and dynamic condition of rotating masses in same and different planes.
3. Determine unbalanced primary, secondary forces and couples in single and multi-cylinder engine.
4. Determine sensitiveness, isochronism, effort and power of porter and hartnell governors.
5. Determine gyroscopic couple and effects related to 2, 4 wheeler, plane disc, ship and aeroplanes.
6. Understand types of vibration, SHM and methods of finding natural frequencies of simple mechanical systems.
7. Determine equation of motion, natural frequency, damping factor, logarithmic decrement of damped free vibration (SDOF) systems.
8. Determine the natural frequency, force and motion transmissibility of single degree freedom systems.
9. Determine equation of motion of rotating and reciprocating unbalance systems, magnification factor, and transmissibility of forced vibration (SDOF) systems.

Text Books:

1. Theory of Machines, Sadhu Singh, Pearson Education, 2nd Edition. 2007.
2. Mechanism and Machine Theory, A. G. Ambekar PHI, 2007
3. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Company,
4. Mechanical Vibrations, G. K. Grover, Nem Chand and Bros.

Reference Books:

1. Theory of Machines, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Mechanical Vibrations, S. S. Rao, Pearson Education Inc, 4th edition, 2003.

TURBO MACHINES

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Turbo Machines	15ME53	04	3-2-0	80	20	3Hrs

Course Objectives:

- The course aims at giving an overview of different types of turbomachinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.
- Explain the working principles of turbomachines and apply it to various types of machines
- It will focus on application of turbo machinery in power generation, power absorption and transportation sectors.

Module 1

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process **(10 Hours)**

Module 2

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

(10 Hours)

Module 3

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

(10 Hours)

Module 4

Hydraulic Turbines: Classification, various efficiencies. **Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and**

Propeller turbines - velocity triangles, design parameters. Problems. **(10 Hours)**

Module 5

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

(10 Hours)

Course Outcomes:

- Able to give precise definition of turbomachinery
- Identify various types of turbo machinery
- Apply the Euler's equation for turbomachinery to analyse energy transfer in turbomachines
- Understand the principle of operation of pumps, fans, compressors and turbines.
- Perform the preliminary design of turbomachines (pumps, rotary compressors and turbines)
- Analyze the performance of turbo machinery.

TEXT BOOKS:

1. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2. Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).

3. Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

DESIGN OF MACHINE ELEMENTS – I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements	15ME54	04	3-2-0	80	20	3Hrs

Course Objectives

1. Able to understand mechanical design procedure, materials, codes and use of standards
2. Able to design machine components for static, impact and fatigue strength.
3. Able to design fasteners, shafts, joints, couplings, keys, threaded fasteners riveted joints, welded joints and power screws.

Module-1

Fundamentals of Mechanical Engineering Design

Mechanical engineering design, Phases of design process, Design considerations, Engineering Materials and their Mechanical properties, Standards and Codes, Factor of safety, Material selection.

Static Stresses: Static loads .Normal, Bending, Shear and Combined stresses. Stress concentration and determination of stress concentration factor.

10 Hours

Module -2

Design for Impact and Fatigue Loads

Impact stress due to Axial, Bending and Torsional loads.

Fatigue failure: Endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, modifying factors: size effect, surface effect. Stress concentration effects, Notch sensitivity, fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

10Hours

Module -3

Design of Shafts, Joints, Couplings and Keys

Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combined loads.

Design of Cotter and Knuckle joints, Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling. Design of keys-square, saddle, flat and father.

10 Hours

Module - 4

Riveted Joints and Weld Joints

Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

10 Hours

Module -5

Threaded Fasteners and Power Screws

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static loads, Design of eccentrically loaded bolted joints. Types of power screws, efficiency and self-locking, Design of power screw, Design of screw jack: (Complete Design).

10 Hours

Course outcomes

On completion of the course the student will be able to

1. Describe the design process, choose materials.
2. Apply the codes and standards in design process.
3. Analyze the behavior of machine components under static, impact, fatigue loading using failure theories.
4. Design shafts, joints, couplings.
5. Design of riveted and welded joints.
6. Design of threaded fasteners and power screws

Text Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition, 2009.

Design Data Handbook:

1. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed.
2. Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication
3. Design Data Hand Book, S C Pilli and H. G. Patil, I. K. International Publisher, 2010.

Reference Books:

1. Machine Design, Robert L. Norton, Pearson Education Asia, 2001.
2. Engineering Design, George E. Dieter, Linda C Schmidt, McGraw Hill Education, Indian Edition, 2013.
3. Design of Machined Elements, S C Pilli and H. G. Patil, I. K. International Publisher, 2017.
4. Machine Design, Hall, Holowenko, Laughlin (Schaum's Outline series) adapted by S.K Somani, tata McGraw Hill Publishing company Ltd., New Delhi, Special Indian Edition, 2008

REFRIGERATION AND AIR-CONDITIONING
(Professional Elective-I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Refrigeration And Air-Conditioning	15ME551	03	3-0-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course objectives

1. Study the basic definition, ASHRAE Nomenclature for refrigerating systems
2. Understand the working principles and applications of different types of refrigeration systems
3. Study the working of air conditioning systems and their applications
4. Identify the performance parameters and their relations of an air conditioning system

Module – I

Introduction to Refrigeration –Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications:Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air.

Industrial Refrigeration-Chemical and process industries, Dairy plants, Petroleum refineries, Food processing and food chain, Miscellaneous
8 Hours

Module – II

Vapour Compression Refrigeration System(VCRS): Comparison of Vapour Compression Cycle and Gas cycle,Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency,Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP – Ewing’s construction and Gosney’s method.Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure,Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.

10 Hours

Module – III

Vapour Absorption Refrigeration Systems: Absorbent – Refrigerant combinations, Water-Ammonia Systems,Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.Practical problems – crystallization and air leakage, Commercial systems

Other types of Refrigeration systems: Brief Discussion on (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermo acoustic refrigeration systems

8

Hours

Module – IV

Refrigerants:Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures

Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.

8 Hours

Module – V

Air-Conditioning: Introduction to Air-Conditioning, Basic Definition, Classification, power rating, ASHRAE Nomenclature pertaining to Air-Conditioning, Applications of Air-Conditioning, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems.

Transport air conditioning Systems: Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Illustrate the principles, nomenclature and applications of refrigeration systems.
2. Explain vapour compression refrigeration system and identify methods for performance improvement
3. Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermo-acoustic refrigeration systems
4. Estimate the performance of air-conditioning systems using the principles of psychrometry.
5. Compute and Interpret cooling and heating loads in an air-conditioning system
6. Identify suitable refrigerant for various refrigerating systems

TEXT BOOKS

1. Roy J. Dossat, Principles of Refrigeration, Wiley Limited
2. Arora C.P., Refrigeration and Air-conditioning, Tata Mc Graw –Hill, New Delhi, 2nd Edition, 2001.
3. Stoecker W.F., and Jones J.W., Refrigeration and Air-conditioning, Mc Graw - Hill, New Delhi 2nd edition, 1982.

REFERENCE BOOKS

1. Dossat, Principles of Refrigeration Pearson-2006.
2. McQuiston, Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition 2000.
3. PITA, Air conditioning 4th edition, Pearson-2005
4. Refrigeration and Air-Conditioning' by Manoharprasad
5. S C Arora & S Domkundwar, Refrigeration and Air-Conditioning Dhanpat Rai Publication
6. <http://nptel.ac.in/courses/112105128/#>

Data Book:

1. Shan K. Wang, Handbook of Air Conditioning and Refrigeration, 2/e, 2001 McGraw-Hill Education
2. Mathur M.L. & Mehta, Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, F.S., Jain Brothers, 2008

E- Learning

- VTU, E- learning, MOOCS, Open courseware

**NON TRADITIONAL MACHINING
(Professional Elective-I)**

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Non Traditional Machining	15ME554	03	3-0-0	80	20	3Hrs

MODULE 1

INTRODUCTION

Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining, selection of non-traditional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

08 hours

MODULE 2

Ultrasonic Machining (USM): Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM.

Abrasive Jet Machining (AJM): Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics- Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.

Water Jet Machining (WJM): Equipment & process, Operation, applications, advantages and limitations of WJM.

08 hours

MODULE 3

ELECTROCHEMICAL MACHINING (ECM)

Introduction, Principle of electro chemical machining: ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish.

Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. ECM Tooling: ECM tooling technique & example, Tool & insulation materials.

Applications ECM: Electrochemical grinding and electrochemical honing process. Advantages, disadvantages and application of ECG, ECH.

CHEMICAL MACHINING (CHM)

Elements of the process: Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process.

Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

10 hours

MODULE 4

ELECTRICAL DISCHARGE MACHINING (EDM)

Introduction, mechanism of metal removal, EDM equipment: spark erosion generator (relaxation type), dielectric medium-its functions & desirable properties, electrode feed control system. Flushing types; pressure flushing, suction flushing, side flushing, pulsed flushing. EDM process parameters: Spark frequency, current & spark gap, surface finish, Heat Affected Zone. Advantages, limitations & applications of EDM, Electrical discharge grinding, Traveling wire EDM.

PLASMA ARC MACHINING (PAM)

Introduction, non-thermal generation of plasma, equipment mechanism of metal removal, Plasma torch, process parameters, process characteristics. Safety precautions. Safety precautions, applications, advantages and limitations.

08 hours

MODULE 5

LASER BEAM MACHINING (LBM)

Introduction, generation of LASER, Equipment and mechanism of metal removal, LBM parameters and characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM)

Introduction, Principle, equipment and mechanism of metal removal, applications, advantages and limitations.

08 hours

Course Outcomes

On completion of the course, the students will be able to

1. Understand the compare traditional and non-traditional machining process and recognize the need for Non-traditional machining process.
2. Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM.
3. Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations.
4. Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM.
5. Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM.

Text Books:

1. Modern Machining Process by P.C Pandey and H S Shah, McGraw Hill Education India Pvt. Ltd. 2000
2. Production technology, HMT, McGraw Hill Education India Pvt. Ltd. 2001

Reference Books

1. New Technology, Dr. Amitabha Bhattacharyya, The Institute of Engineers (India), 2000
2. Modern Machining process, Aditya, 2002.

ENERGY AND ENVIRONMENT
(OPEN ELECTIVE – I)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy And Environment	15ME562	03	3-0-0	80	20	3Hrs

Course Objectives

1. Understand energy scenario, energy sources and their utilization
2. Learn about methods of energy storage, energy management and economic analysis
3. Have proper awareness about environment and eco system.
4. Understand the environment pollution along with social issues and acts.

Module – I

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption, Key energy trends in India: Demand, Electricity, Access to modern energy, Energy production and trade, Factors affecting India's energy development: Economy and demographics Policy and institutional framework, Energy prices and affordability, Social and environmental aspects, Investment. **8 Hours**

Module – II

Energy storage systems: Thermal energy storage methods, Energy saving, Thermal energy storage systems

Energy Management: Principles of Energy Management, Energy demand estimation, Energy pricing

Energy Audit: Purpose, Methodology with respect to process Industries, Characteristic method employed in Certain Energy Intensive Industries

Economic Analysis: Scope, Characterization of an Investment Project

10 Hours

Module – III

Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.

Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. **8 Hours**

Module – IV

Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards, Solid waste Management, Disaster management Role of an individual in prevention of pollution, Pollution case studies. **8 Hours**

Module – V

Social Issues and the Environment: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation.

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

1. Summarize the basic concepts of energy, its distribution and general Scenario.
2. Explain different energy storage systems, energy management, audit and economic analysis.
3. Summarize the environment eco system and its need for awareness.
4. Identify the various types of environment pollution and their effects.
5. Discuss the social issues of the environment with associated acts.

TEXT BOOKS:

1. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education by University grant commission and Bharathi Vidyapeeth Institute of environment education and Research ,Pune
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.

REFERENCE BOOKS:

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. Murphy, W. R., Energy Management, Elsevier, 2007.
3. Smith, C. B., Energy Management Principles, Pergamum, 2007
4. Environment pollution control Engineering by C S rao, New Age Inytermnational, 2006, reprint 2015, 2nd edition
5. Environmental studies, by Benny Joseph, Tata McGraw Hill, 2008, 2nd edition.

E- Learning

- India Energy Outlook 2015(www.iea.org/.../IndiaEnergyOutlook_WEO2015.pdf)
- Open courseware

FLUID MECHANICS & MACHINERY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Mechanics & Machinery Lab	15MEL57	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Turbo Machines

Prerequisites : Fluid Mechanics and Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.
2. Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of coefficient of friction of flow in a pipe.
3. Determination of minor losses in flow through pipes.
4. Application of momentum equation for determination of coefficient of impact of jets on flat and curved blades
5. Calibration of flow measuring devices.
6. Orifice meter
 - o Nozzle
 - o Venturimeter
 - o V-notch

PART – B

7. Performance on hydraulic Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
8. Performance hydraulic Pumps
 - d. Single stage and Multi stage centrifugal pumps
 - e. Reciprocating pump
9. Performance test on a two stage Reciprocating Air Compressor
10. Performance test on an Air Blower

PART – C (Optional)

11. Visit to Hydraulic Power station/ Municipal Water Pump House and Case Studies
12. Demonstration of cut section models of Hydraulic turbines and Pumps.

Course Outcomes:

At the end of this course students are able to,

1. Perform experiments to determine the coefficient of discharge of flow measuring devices.
2. Conduct experiments on hydraulic turbines and pumps to draw characteristics.
3. Test basic performance parameters of hydraulic turbines and pumps and execute the knowledge in real life situations.
4. Determine the energy flow pattern through the hydraulic turbines and pumps
5. Exhibit his competency towards preventive maintenance of hydraulic machines

Reading:

1. K.L.Kumar.“Engineering Fluid Mechanics” Experiments, Eurasia Publishing House, 1997
2. Jagdish Lal, Hydraulic Machines, Metropolitan Book Co, Delhi, 1995
3. [George E. Totten](#) , [Victor J. De Negri](#) “Handbook of Hydraulic Fluid Technology, Second Edition, 2011.

Scheme of Examination:

ONE question from part -A: 25 Marks
ONE question from part -B: 40 Marks
Viva –Voice : 15 Marks
Total: 80 Marks

ENERGY LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Lab	15MEL58	02	1-0-2	80	20	3Hrs

Prerequisites: Basic and Applied Thermodynamics

Course Objectives:

1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
3. Exhaust emissions of I C Engines will be measured and compared with the standards.

PART – A

1. Lab layout, calibration of instruments and standards to be discussed
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of solid, liquid and gaseous fuels.
4. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Analysis of moisture, volatile matter, ash content and fixed carbon of solid and liquid fuel samples
6. Valve Timing/port opening diagram of an I.C. Engine.

PART - B

7. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for
 - a. Four stroke Diesel Engine
 - b. Four stroke Petrol Engine
 - c. Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - d. Two stroke Petrol Engine
 - e. Variable Compression Ratio I.C. Engine.
8. Measurements of Exhaust Emissions of Petrol engine.
9. Measurements of Exhaust Emissions of Diesel engine.
10. Measurement of $p\theta$, pV plots using Computerized IC engine test rig

PART – C (Optional)

11. Visit to Automobile Industry/service stations.
12. CFD Analysis of design, development, performance evaluation and process optimization in I C Engines.

Course Outcomes: At the end of this course students are able to,

1. Perform experiments to determine the properties of fuels and oils.
2. Conduct experiments on engines and draw characteristics.
3. Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
4. Identify exhaust emission, factors affecting them and report the remedies.
5. Determine the energy flow pattern through the I C Engine
6. Exhibit his competency towards preventive maintenance of IC engines.

References

1. E.F.Obert, Internal combustion engines and air pollution intext educational publishers (1973). John Heywood, Internal combustion engine fundamentals, McGraw- Hill (1988) - USA.
2. Colin R Ferguson and Allan T. Kirkpatrick Internal combustion engines Applied Thermodynamics, John Wiley & sons –2001.
3. Richard stone, Introduction to internal combustion engines, MacMillan (1992) – USA
4. M. L. Mathur And R.P. Sharma A course in internal combustion engines, Dhanpat Rai& sons- India.
5. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
6. C. F. Taylor The internal combustion engines in theory and practice, 2 vols. by:, pub.: Wily.
7. Ganesan, V., Fundamentals of IC Engines, Tata McGraw Hill, 2003
8. Bosch, Automotive hand book, 9th edition.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

B.E. Mechanical Engineering

VI SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME61	Finite Element Analysis	3	2	0	03	80	20	100	4
2	15ME62	Computer integrated Manufacturing	4	0	0	03	80	20	100	4
3	15ME63	Heat Transfer	3	2	0	03	80	20	100	4
4	15ME64	Design of Machine Elements -II	3	2	0	03	80	20	100	4
5	15ME65X	Professional Elective-II	3	0	0	03	80	20	100	3
6	15ME66X	Open Elective-II	3	0	0	03	80	20	100	3
7	15MEL67	Heat Transfer Lab	1	0	2	03	80	20	100	2
8	15MEL68	Modeling and Analysis Lab(FEA)	1	0	2	03	80	20	100	2
TOTAL			21	6	04		640	160	800	26

Professional Elective-II		Open Elective-II	
15ME653	Metal Forming	15ME664	Total Quality Management
15ME655	Automobile Engineering		

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. OpenElective:** Electives from other technical and/or emerging subject areas.

FINITE ELEMENT ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Finite Element Analysis	15ME61	04	3-2-0	80	20	3Hrs

Course Objectives:

1. To learn basic principles of finite element analysis procedure .
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Module I

Introduction to Finite Element Method :General description of the finite element method. Engineering applications of finite element method. Boundary conditions: homogeneous and nonhomogeneous for structural, heat transfer and fluid flow problems.Potential energy method, Rayleigh Ritz method, Galerkin's method, Displacement method of finite element formulation. Convergence criteria, Discretisation process, Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain displacement relations, Stress strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, Linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

10 Hours

Module II

One-Dimensional Elements-Analysis of Bars and Trusses,

Linear interpolation polynomials in terms of localcoordinate's for1D, 2Delements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, , , Constant strain triangle, Four-Nodded Tetrahedral Element (TET 4), Eight-Nodded Hexahedral Element (HEXA

8), 2D isoparametric element, Lagrange interpolation functions, Numerical integration: Gaussian quadrature one point, two point formulae, 2D integrals. Fore terms: Body force, traction force and point loads,

Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach, Analysis of trusses.

10 Hours

Module III

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions, Beam stiffness matrix based on Euler-Bernoulli beam theory, Examples on cantilever beams, propped cantilever beams, Numerical problems on simply supported, fixed straight and stepped beams using direct stiffness method with concentrated and uniformly distributed load.

Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

08 Hours

Module IV

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid, 1D finite element formulation using vibrational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.

Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic net works.

10 Hours

Module V

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.

Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilateral element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind formulation methods in FEM.
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
3. Develop element characteristic equation and generation of global equation.
4. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

12Hours

Text Books:

1. Logan, D. L., A first course in the finite element method, 6th Edition, Cengage Learning, 2016.
2. Rao, S. S., Finite element method in engineering, 5th Edition, Pergaman Int. Library of Science, 2010.
3. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.

Reference Books:

1. J.N.Reddy, “**Finite Element Method**”- McGraw -Hill International Edition. Bathe K. J. Finite Elements Procedures, PHI.
2. Cook R. D., et al. “**Concepts and Application of Finite Elements Analysis**”- 4th Edition, Wiley & Sons, 2003.

Computer Integrated Manufacturing

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing	15ME62	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To impart knowledge of CIM and Automation and different concepts of automation by developing mathematical models.
CLO2	To make students to understand the Computer Applications in Design and Manufacturing [CAD / CAM) leading to Computer integrated systems. Enable them to perform various transformations of entities on display devices.
CLO3	To expose students to automated flow lines, assembly lines, Line Balancing Techniques, and Flexible Manufacturing Systems.
CLO4	To expose students to computer aided process planning, material requirement planning, capacity planning etc.
CLO5	To expose the students to CNC Machine Tools, CNC part programming, and industrial robots.
CLO6	To introduce the students to concepts of Additive Manufacturing, Internet of Things, and Industry 4.0 leading to Smart Factory.

Module - 1

1. Introduction to CIM and Automation:

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated Manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in-process, numerical problems. **5 Hours**

2. Automated Production Lines and Assembly Systems: Fundamentals, system configurations, applications, automated flow lines, buffer storage, control of production line, analysis of transfer lines, analysis of flow lines without storage, partial automation, analysis of automated flow lines with storage buffer, fundamentals of automated assembly systems, numerical problems. **5 Hours**

Module – 2

3. CAD and Computer Graphics Software: The design process, applications of computers in design, software configuration, functions of graphics package, constructing the geometry.

Transformations: 2D transformations, translation, rotation and scaling, homogeneous transformation matrix, concatenation, numerical problems on transformations.

5 Hours

4. Computerized Manufacture Planning and Control System: Computer Aided Process Planning, Retrieval and Generative Systems, benefits of CAPP, Production Planning and Control Systems, typical activities of PPC System, computer integrated production management system, Material Requirement Planning, inputs to MRP system, working of MRP, outputs and benefits, Capacity Planning, Computer Aided Quality Control, Shop floor control.

5 Hours

Module- 3

5. Flexible Manufacturing Systems: Fundamentals of Group Technology and Flexible Manufacturing Systems, types of FMS, FMS components, Material handling and storage system, applications, benefits, computer control systems, FMS planning and design issues, Automated Storage and Retrieval Systems, AS/RS and Automatic parts identification systems and data capture.

5 Hours

6. Line Balancing: Linebalancing algorithms, methods of line balancing, numerical problems on largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights method, Mixed Model line balancing, computerized line balancing methods.

5 Hours

Module-4.

7. Computer Numerical Control: Introduction, components of CNC, CNC programming, manual part programming, G Codes, M Codes, programming of simple components in turning, drilling and milling systems, programming with canned cycles. Cutter radius compensations.

5 Hours

8. Robot Technology: Robot anatomy, joints and links, common robot configurations, robot control systems, accuracy and repeatability, end effectors, sensors in robotics.

Robot programming methods: on-line and off-line methods.

Robot industrial applications: material handling, processing and assembly and inspection.

5 Hours

Module – 5

9. Additive Manufacturing Systems: Basic principles of additive manufacturing, slicing CAD models for AM, advantages and limitations of AM technologies, Additive manufacturing processes: Photo polymerization, material jetting, binder jetting, material extrusion, Powder bed sintering techniques, sheet lamination, direct energy deposition techniques, applications of AM. Recent trends in manufacturing, Hybrid manufacturing. **5 Hours**

10. Future of Automated Factory: Industry 4.0, functions, applications and benefits. Components of Industry 4.0, Internet of Things (IOT), IOT applications in manufacturing, Big-Data and Cloud Computing for IOT, IOT for smart manufacturing, influence of IOT on predictive maintenance, industrial automation, supply chain optimization, supply-chain & logistics, cyber-physical manufacturing systems. **5 Hours**

Course Outcomes:

After studying this course, students will be able to:

CO1	Able to define Automation, CIM, CAD, CAM and explain the differences between these concepts. Solve simple problems of transformations of entities on computer screen.
CO2	Explain the basics of automated manufacturing industries through mathematical models and analyze different types of automated flow lines.
CO3	Analyze the automated flow lines to reduce down time and enhance productivity.
CO4	Explain the use of different computer applications in manufacturing, and able to prepare part programs for simple jobs on CNC machine tools and robot programming.
CO5	Visualize and appreciate the modern trends in Manufacturing like additive manufacturing, Industry 4.0 and applications of Internet of Things leading to Smart Manufacturing.

Text Books:

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 4th Edition, 2015, Pearson Learning.
2. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw-Hill.
3. CAD/CAM/CIM, Dr. P. Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi.

Reference Books:

1. “CAD/CAM” by Ibrahim Zeid, Tata McGraw Hill.
2. “Principles of Computer Integrated Manufacturing”, S.Kant Vajpayee, 1999, Prentice Hall of India, New Delhi.

3. “Work Systems And The Methods, Measurement And Management of Work”, Groover M. P., Pearson/Prentice Hall, Upper Saddle River, NJ, 2007.
4. “Computer Automation in Manufacturing”, Boucher, T. O., Chapman & Hall, London, UK, 1996.
5. “Introduction to Robotics: Mechanics And Control”, Craig, J. J., 2nd Ed., Addison-Wesley Publishing Company, Reading, MA, 1989.
6. Internet of Things (IoT): Digitize or Die: Transform your organization. Embrace the digital evolution. Rise above the competition, by Nicolas Windpassinger, Amazon.
7. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
9. **“Understanding Additive Manufacturing”**, Andreas Gebhardt, Hanser Publishers, 2011
10. Industry 4.0: The Industrial Internet of Things, Apress, 2017, by Alasdair Gilchrist

Heat Transfer

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer	15ME63	04	3-2-0	80	20	3Hrs

Pre-requisites: Basic and Applied Thermodynamics

Course learning objectives:

- Study the modes of heat transfer.
- Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
- Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
- Study the basic principles of heat exchanger analysis and thermal design.
- Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.

Module – I

Introductory concepts and definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer combined heat transfer mechanism, Types of boundary conditions. General Heat Conduction Equation: Derivation of the equation in (i) Cartesian, (ii) Polar and (iii) Spherical Co-ordinate Systems.

Steady-state one-dimensional heat conduction problems in Cartesian System: Steady-state one-dimensional heat conduction problems (i) with and without heat generation and (ii) with and without varying thermal conductivity - in Cartesian system with various possible boundary conditions, Thermal Resistances in Series and in Parallel. **8 Hours**

Module – II

Critical Thickness of Insulation: Concept, Derivation, Extended Surfaces or Fins: Classification, Straight Rectangular and Circular Fins, Temperature Distribution and Heat Transfer Calculations, Fin Efficiency and Effectiveness, Applications

Transient [Unsteady-state] heat conduction: Definition, Different cases - Negligible internal thermal resistance, negligible surface resistance, comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems, Heisler and Grober charts. **9 Hours**

Module – III

Numerical Analysis of Heat Conduction: Introduction, one-dimensional steady conduction, one dimensional unsteady conduction, two-dimensional steady and unsteady conduction, the difference equation, boundary conditions, solution methods, cylindrical coordinates and irregular boundaries.

Thermal Radiation: Fundamental principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Wien's, Rayleigh-Jeans' and Planck's laws, Hemispherical Emissive Power, Stefan-Boltzmann law for the total emissive power of a black body, Emissivity and Kirchhoff's Laws, View factor, Net radiation exchange in a two-body enclosure, Typical examples for these enclosures, Radiation Shield. **9 Hours**

Module – IV

Forced Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers, Prandtl number, Governing Equations – Continuity, Navier-Stokes and Energy equations, Boundary layer assumptions, Integral and Analytical solutions to above equations, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Internal flows –laminar and turbulent flow solutions, Forced Convection Cooling of Electronic Devices.

Free convection: Laminar and Turbulent flows, Vertical Plates, Vertical Tubes and Horizontal Tubes, Empirical solutions.

8 Hours

Module – V

Heat Exchangers: Definition, Classification, applications, LMTD method, Effectiveness - NTU method, Analytical Methods, Fouling Factors, Chart Solution Procedures for solving Heat Exchanger problems: Correction Factor Charts and Effectiveness-NTU Charts, compact heat exchangers.

Heat Transfer with Phase Change: Introduction to boiling, pool boiling, Bubble Growth Mechanisms, Nucleate Pool Boiling, Critical Heat Flux in Nucleate Pool Boiling, Pool Film Boiling, Critical Heat Flux, Heat Transfer beyond the Critical Point, filmwise and dropwise Condensation, heat pipes, entrainment, wicking and boiling limitations.

9 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Understand the basic modes of heat transfer.
- Compute temperature distribution in steady-state and unsteady-state heat conduction
- Understand and interpret heat transfer through extended surfaces.
- Interpret and compute forced and free convective heat transfer.
- Explain the principles of radiation heat transfer and understand the numerical formula for heat conduction problems.
- Design heat exchangers using LMTD and NTU methods.

TEXT BOOKS:

1. Principals of heat transfer, Frank Kreith, Raj M. Manglik, Mark S. Bohn, Seventh Edition, Cengage learning, 2011.
2. Yunus A. Cengel - Heat transfer, a practical approach, Fifth edition, Tata Mc Graw Hill.

REFERENCE BOOKS:

1. Heat and mass transfer, Kurt C. Rolle, second edition, Cengage learning.
2. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.
3. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and De Witt, D. P., 5th Edition, John Wiley and Sons, New York, 2006.
4. Heat Transfer, Holman, J. P., 9th Edition, Tata McGraw Hill, New York, 2008.

E-Books/Web references:

1. A Text book of Heat Transfer, John H Lienhard, 4th Edition,
2. NPTEL Heat Transfer course for Mechanical Engineering, <http://nptel.ac.in/courses/112101097/>
3. Heat Transfer, Chris Long & Naser Sagma, Bookboon.com

MOOCs:

1. Fluid flow, Heat and Mass Transfer- <http://ocw.tudelft.nl/courses/applied-earth-sciences/fluid-flow-heat-mass-transfer/course>
2. Heat transfer course- <https://legacy.saylor.org/me204/Intro/>

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN OF MACHINE ELEMENTS II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements II	15ME64	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To understand various elements involved in a mechanical system.
CLO2	To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
CLO3	To select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.
CLO4	To design completely a mechanical system integrating machine elements.
CLO5	To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

MODULE I

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

Cylinders & Cylinder Heads: Review of Lamé's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats.

08 Hours

MODULE 2

Belts: Materials of construction of flat and V belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains. (Only theoretical treatment)

Springs:Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs;springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs,equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs.

10 Hours

MODULE 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear.

12 Hours

MODULE 4

Worm Gears:Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches:Types of clutches and their applications, single plate and multi-plate clutches.

(Numerical examples only on single and multi-plate clutches)

Design of Brakes:Types of Brakes, Block and Band brakes,selflocking of brakes, and heat generation in brakes.

10 Hours

MODULE 5

Lubrication and Bearings:Lubricants and their properties, bearing materials and properties;mechanisms of lubrication,hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.

Numerical examples on hydrodynamic journal and thrust bearing design.

Anti friction bearings:Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

10 Hours

Course Outcomes:

After learning the course the students should be able to:

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs, belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers, catalogue.
CO7	Develop proficiency to generate production drawings using CAD software.
CO8	Become good design engineers through learning the art of working in a team with morality and ethics.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Assignment:

Course work includes a **Design project**. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, single plate clutch, etc.) A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit (5 marks) in internal assessment.

Textbooks:

- [1] Richard G. Budynas, and J. Keith Nisbett, "Shigley's Mechanical Engineering Design", McGraw-Hill Education, 10th Edition, 2015.
- [2] Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, Wiley student edition, 2007.
- [3] V. B. Bhandari, "Design of Machine Elements", 4th Ed., Tata Mcgraw Hill, 2016.

References:

- [1] Robert L. Norton "Machine Design- an integrated approach", Pearson Education, 2nd edition.
- [2] Spotts M.F., Shoup T.E "Design and Machine Elements", Pearson Education, 8th edition, 2006.
- [3] Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.

[4] Hall, Holowenko, Laughlin (Schaum's Outline Series), "Machine design" adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.

[5] G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill, 2nd edition,2004.

Design Data Hand Book:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.

[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.

[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010

[4]PSG Design Data Hand Book, PSG College of technology, Coimbatore.

METAL FORMING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Metal Forming	15ME653	3	3-0-0	80	20	3Hrs

Course objectives:

The course is intended to provide basic understanding of Metal Forming with following aspects:

- To acquaint with the basic knowledge on fundamentals of metal forming processes
- To study various metal forming processes
- Understanding plastic deformation during forming processes

MODULE -1

Introduction to Metal Forming: Classification of metal forming processes, advantages and limitations, stress-strain relations in elastic and plastic deformation. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress, principal stresses, yield criteria and their significance, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain. Deformation mechanisms, Hot and Cold working processes and its effect on mechanical properties. **10 Hrs**

MODULE -2

Effects of Parameters: Metallurgical aspects of metal forming, slip, twinning mechanics of plastic deformation, Effects of Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

Forging: Classification of forging processes. Forging machines equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging, forging defects, residual stresses in forging. Simple problems. **10 Hrs**

MODULE -3

Rolling: Classification of rolling processes. Types of rolling mills, expression for rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables. Simple problems.

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing. Simple problems. **10 Hrs**

MODULE -4

Extrusion:Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, extrusion of seamless tubes. Extrusion variables. Simple problems.

Sheet Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring. Simple problems. **10 Hrs**

MODULE -5

High Energy Rate Forming Methods & Powder Metallurgy: High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations. **10 Hrs**

Course outcomes:

On completion of this subject, students will be:

2. Able to understand the concept of different metal forming process.
3. Able to approach metal forming processes both analytically and numerically
4. Able to design metal forming processes
5. Able to develop approaches and solutions to analyze metal forming processes and the associated problems and flaws.

TEXT BOOKS:

1. Mechanical metallurgy (SI Units), G.E.Dieter, McGraw hill Pub-2001.
2. Production Technology (Manufacturing process, technology and Automation), R.K Jain, Khanna Publishers-2004.
3. Manufacturing Science, Amithab Gosh & A.K.Malik, East-West press 2001.
4. Production Technology Vol-II by O. P. Khanna & Lal, Dhanpat Rai Publications-2012.
5. A Course in Workshop Technology Vol: 1, Manufacturing Process, B.S Raghuwanshi, Published by Dhanpat Rai & Co (P) Ltd.-2014.

REFERENCE BOOKS:

1. Materials & Process in Manufacturing – E.Paul, Degramo, J.T.Black, Ranold, A.K.Prentice-hall of India 2002
2. Elements of Workshop Technology Vol:1, S.K.Hajra Choudhury, Media Promoters & Publishers Pvt Ltd.-2008.
3. Fundamentals of Manufacturing Processes by Lal G K , Narosa
4. Textbook of Production Engineering by P. C. Sharma, S Chand & Company Ltd.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

AUTOMOBILE ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam duration
				SEE	CIA	
Automobile	15ME655	3	3-0-0	80	20	3 Hrs

Course learning objectives: The student will be able to learn

- The layout and arrangement of principal parts of an automobile
- The working of transmission and brake systems
- The operation and working of steering and suspension systems
- To know the Injection system and its advancements
- To know the automobile emissions and its effects on environment

MODULE 1

ENGINE COMPONENTS AND IT'S PRINCIPLE PARTS: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, methods of a Swirl generation, choice of materials for different engine components, engine positioning. Concept of HCCI engines, hybrid engines, twin spark engine, electric car.

COOLING AND LUBRICATION: cooling requirements, types of cooling- thermo siphon system, forced circulation water cooling system, water pump, Radiator, thermostat valves. Significance of lubrication, splash and forced feed system. **10 Hours**

MODULE 2

TRANSMISSION SYSTEMS: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

BRAKES: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical **08 Hours**

MODULE 3

STEERING AND SUSPENSION SYSTEMS: Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Suspension, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel, Air suspension system.

IGNITION SYSTEM: Battery Ignition system, Magneto Ignition system, electronic Ignition system. **08 Hours**

MODULE 4

SUPERCHARGERS AND TURBOCHARGERS: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

FUELS, FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors. Electronic Injection system, Common Rail Direct Injection System.

08 Hours

MODULE 5

AUTOMOTIVE EMISSION CONTROL SYSTEMS: Different air pollutants, formation of photochemical smog and causes. Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter.

EMISSION STANDARDS: Euro I, II, III and IV norms, Bharat Stage II, III, IV norms. Motor Vehicle Act

08 Hours

Course Outcomes: Student will be able

- To identify the different parts of an automobile and it's working
- To understand the working of transmission and braking systems
- To comprehend the working of steering and suspension systems
- To learn various types of fuels and injection systems
- To know the cause of automobile emissions ,its effects on environment and methods to reduce the emissions.

TEXT BOOKS:

1. Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
2. Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
2. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
3. Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
4. Automobile Engineering, R. B. Gupta, Satya Prakashan,(4th Edition) 1984.

TOTAL QUALITY MANAGEMENT

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Total Quality Management	15ME664	03	3-0-0	80	20	3Hrs

COURSE LEARNING OBJECTIVES:

This course enables students to

1. Understand various approaches to TQM
2. Understand the characteristics of quality leader and his role.
3. Develop feedback and suggestion systems for quality management.
4. Enhance the knowledge in Tools and Techniques of quality management

Module - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

08 Hours

Module - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

08 Hours

Module - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

08 Hours

Module - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDCA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies

Module - 5

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

08 Hours

COURSE OUTCOMES:

Student will be able to

1. Explain the various approaches of TQM
2. Infer the customer perception of quality
3. Analyze customer needs and perceptions to design feedback systems.
4. Apply statistical tools for continuous improvement of systems
5. Apply the tools and technique for effective implementation of TQM.

TEXT BOOKS:

1. Total Quality Management: Dale H. Besterfield, Publisher -Pearson Education India, ISBN: 8129702606, Edition 03.
2. Total Quality Management for Engineers: M. Zairi, ISBN:1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. Managing for Quality and Performance Excellence by James R.Evans and William M Lindsay, 9th edition, Publisher Cengage Learning.
- 2 A New American TQM, four revolutions in management, Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
3. Organizational Excellence through TQM, H. Lal, New age Publications, 2008

Reference Books:

1. Engineering Optimization Methods and Applications, A Ravindran, K, M.Ragsdell, Wiley India Private Limited, 2nd Edition, 2006.
2. : Introduction to Operations Research- Concepts and Cases, F.S. Hillier. G.J. Lieberman, 9th Edition, Tata McGraw Hill. 2010.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Heat Transfer Lab

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Heat Transfer Lab	15MEL67	02	1-0-2	80	20	3Hrs

Co-requisite Courses: Heat Transfer

Course Objectives:

- The primary objective of this course is to provide the fundamental knowledge necessary to understand the behavior of thermal systems.
- This course provides a detailed experimental analysis, including the application and heat transfer through solids, fluids, and vacuum. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

PART – A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.
7. Analysis of steady and transient heat conduction, temperature distribution of plane wall and cylinder using Numerical approach (ANSYS/CFD package).

PART – B

1. Determination of Steffan Boltzmann Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
3. Experiments on Boiling of Liquid and Condensation of Vapour.
4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air – Conditioner.
6. Experiment on Transient Conduction Heat Transfer.
7. Determination of temperature distribution along a rectangular and circular fin subjected to heat loss through convection using Numerical approach (ANSYS/CFD package)

Course Outcomes: At the end of this course students are able to,

- Perform experiments to determine the thermal conductivity of a metal rod

- Conduct experiments to determine convective heat transfer coefficient for free and forced convection and correlate with theoretical values.
- Estimate the effective thermal resistance in composite slabs and efficiency in pin-fin
- Determine surface emissivity of a test plate
- Estimate performance of a refrigerator and effectiveness of fin
- Calculate temperature distribution of study and transient heat conduction through plane wall, cylinder and fin using numerical approach.

Reading:

1. M. Necati Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York, 2005.
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 5th Edition, John Wiley and Sons, New York, 2006.
3. Holman, J. P., Heat Transfer, 9th Edition, Tata McGraw Hill, New York, 2008.

Scheme of Examination:

ONE question from part -A: 25 Marks

ONE question from part -B: 40 Marks

Viva –Voice : 15 Marks

Total: 80 Marks

Modeling and Analysis Lab (FEA)

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Modeling and Analysis Lab	15MEL68	02	1-0-2	80	20	3Hrs

CREDITS – 02

Prerequisites: Knowledge of any Modeling software, knowledge of coordinate systems and Geometric transformations etc.

Course objectives:

The course is intended to provide basic understanding of Modeling and Analysis techniques students with following aspects:

- To acquire basic understanding of Modeling and Analysis software
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

PART – A

Study of a FEA package and modeling and stress analysis of:

1. Bars of constant cross section area, tapered cross section area and stepped bar
2. Trusses – **(Minimum 2 exercises of different types)**
3. Beams – Simply supported, cantilever, beams with point load , UDL, beams with varying load etc **(Minimum 6 exercises different nature)**
4. Stress analysis of a rectangular plate with a circular hole

PART - B

- 1) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions **(Minimum 4 exercises of different types)**
- 2) Dynamic Analysis to find
 - a) Fixed – fixed beam for natural frequency determination

- b) Bar subjected to forcing function
- c) Fixed – fixed beam subjected to forcing function

PART – C (only for demo and oral exam)

- 1) Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver
- 2) Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
- 3) Demonstrate at least two different type of example to model and analyze bars or plates made from composite material

Course Outcomes: At the end of the course the students are able to:

- Demonstrate the basic features of an analysis package.
- Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition to solve problems of bars, truss, beams, plate to find stress with different-loading conditions.
- Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.
- Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions.
- Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomson, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A - 32 Marks (08 Write up +24)

One Question from Part B - 32 Marks (08 Write up +24)

Viva-Voce - 16 Marks

Total 80 Marks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME71	Energy Engineering	3	2	0	03	80	20	100	4
2	15ME72	Fluid Power Systems	4	0	0	03	80	20	100	4
3	15ME73	Control Engineering	3	2	0	03	80	20	100	4
4	15ME74X	Professional Elective - III	3	0	0	03	80	20	100	3
5	15ME75X	Professional Elective-IV	3	0	0	03	80	20	100	3
6	15MEL76	Design Lab	1	0	2	03	80	20	100	2
7	15MEL77	CIM Lab	1	0	2	03	80	20	100	2
8	15MEP78	Project Phase – I	-	-	-	-	-	100	100	2
TOTAL			18	4	04		560	240	800	24

Professional Elective-III		Professional Elective-IV	
15ME742	Tribology	15ME753	Mechatronics

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch

ENERGY ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Energy Engineering	15ME71	04	3-2-0	80	20	3Hrs

Course learning objectives is to

- Understand energy scenario, energy sources and their utilization
- Learn about energy conversion methods and their analysis
- Study the principles of renewable energy conversion systems
- Understand the concept of green energy and zero energy.

Module – I

Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oilburners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft, Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air preheaters and re-heaters.

9 Hours

Module – II

Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

Hydro-Electric Energy: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

7 Hours

Module – III

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data, Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems, Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

8 Hours

Module – IV

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

8 Hours

Module – V

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics Nuclear, ocean, MHD, thermoelectric and geothermal energy applications; Origin and their types; Working principles, Zero energy Concepts

8 Hours

Course Outcomes

At the end of the course, the student will be able to:

- Summarize the basic concepts of thermal energy systems,
- Identify renewable energy sources and their utilization.
- Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
- Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas.
- Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
- Identify methods of energy storage for specific applications

TEXT BOOKS:

1. B H Khan, Non conventional energy resources, 3rd Edition, McGraw Hill Education
2. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996

REFERENCE BOOKS:

1. S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. C. S. Solanki, "Solar Photovoltaic's: Fundamental Applications and Technologies, Prentice Hall of India, 2009.
3. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

Scheme of Examination: Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

FLUID POWER SYSTEMS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Fluid Power Systems	15ME72	04	3-2-0	80	20	3Hrs

Course objectives:

CLO1	To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
CLO2	To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
CLO3	To examine concepts centering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
CLO4	Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
CLO5	To familiarize with logic controls and trouble shooting

Module 1: Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

10 hours

Module 2: Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, selection/ design procedure, applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flowrate, and hydraulic motor performance; numerical problems. Symbolic representation of hydraulic actuators (cylinders and motors).

10 hours

Module 3: Components and hydraulic circuit design

Components: Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design:Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application,hydrauliccylinder sequencing circuits, cylinder synchronizing circuit using different methods, hydraulic circuit for force multiplication;speedcontrol of hydraulic cylinder- metering in, metering out and bleed off circuits.Pilot pressure operated circuits.Hydraulic circuit examples withaccumulator.

10 hours

Module4: Pneumatic power systems

Introduction to Pneumatic systems:Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder –types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

10 hours

Module5: Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications.

Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method-principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

10 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Identify and analyse the functional requirements of a fluid power transmission system for a
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	given application.
CO2	Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3	Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application.
CO4	Select and size the different components of the circuit.
CO5	Develop a comprehensive circuit diagram by integrating the components selected for the given application.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with applications", Pearson edition, 2000 .
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2002 .
3. Majumdar S.R., "Pneumatic systems - Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2005

REFERENCE BOOKS:

1. John Pippenger, Tyler Hicks, "Industrial Hydraulics", McGraw Hill International Edition, 1980.
2. Andrew Par, Hydraulics and pneumatics, Jaico Publishing House, 2005.
3. FESTO, Fundamentals of Pneumatics, Vol I, II and III.
4. Herbert E. Merritt, "Hydraulic Control Systems", John Wiley and Sons, Inc.
5. Thomson, Introduction to Fluid power, Prentice Hall, 2004
6. John Watton, "Fundamentals of fluid power control", Cambridge University press, 2012.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

- a. Speed control circuit using metering in and metering out technique
- b. Regenerative and sequencing circuits.
- c. Extend-Retract and Stop system of a linear actuator
- d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

- a. Automatic reciprocating circuit
- b. Speed control circuit
- c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
- d. Electro pneumatic valves and circuit

Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment (5 Marks).

List of Open Source Software/learning website:

1. Simulink
2. SimHydraulics

CONTROL ENGINEERING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Control Engineering	15ME73	04	3-2-0	80	20	3Hrs

Course Objectives	<ol style="list-style-type: none"> 1. Modeling of mechanical, hydraulic, pneumatic and electrical systems. 2. Representation of system elements by blocks and its reduction 3. Transient and steady state response analysis of a system. 4. Frequency response analysis using polar plot. 5. Frequency response analysis using bode plot. 6. Analysis of system using root locus plots. 7. Different system compensators and variable characteristics of linear systems.
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MODULE I

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

(7 Hours)

MODULE 2

Modeling of Physical Systems :Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.
(3 hours)

Analogous Systems: Direct and inverse analogs for mechanical, thermal and fluid systems.

(4 hours)

Block diagram Algebra: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula

(6 Hours)

MODULE 3

Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.
(3 hours)

Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.
(4 hours)

Root Locus Plots : Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation
(6 Hours)

MODULE 4

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins
(14 Hours)

MODULE 5

System Compensation and State Variable Characteristics of Linear Systems :Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test .

(7 Hours)

Course Outcomes
CO1: Recognize control system and its types , control actions
CO2: Determine the system governing equations for physical models(Electrical, Thermal, Mechanical, Electro Mechanical)
CO3: Calculate the gain of the system using block diagram and signal flow graph
CO4: Illustrate the response of 1st and 2nd order systems
CO5: Determine the stability of transfer functions in complex domain and frequency domain
CO6: Employ state equations to study the controllability and observability

TRIBOLOGY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Tribology	15ME742	03	3-0-0	80	20	3Hrs

Course objectives:

CLO1	To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants.
CLO2	To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems.
CLO3	To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
CLO4	To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
CLO5	To introduce the concepts of surface engineering and its importance in tribology.

Module 1

Introduction to tribology: Historical background, practical importance, and subsequent use in the field.

Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

8 hours

Module 2

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

8 hours

Module 3

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D.

Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and its significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

10 hours

Module 4

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

8 hours

Module5

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering.

Surface modification – transformation hardening, surface melting, thermo chemical processes.

Surface Coating – plating, fusion processes, vapor phase processes.

Selection of coating for wear and corrosion resistance.

8 hours

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1	Understand the fundamentals of tribology and associated parameters.
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.
CO4	Select proper bearing materials and lubricants for a given tribological application.
CO5	Apply the principles of surface engineering for different applications of tribology.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Use of approved Design Data Handbook/charts can be permitted during the examination.

TEXTBOOKS:

1. "Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3. "Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCES:

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M. Hutchings, Edward Arnold, London, 1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann, 1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons, 1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B. Bhushan, B.K. Gupta, McGraw-Hill, 1997.

MECHATRONICS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Mechatronics	15ME753	03	3-0-0	80	20	3 Hrs

Course objectives:

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Understand the applications of microprocessors in various systems and to know the functions of each element
4. Demonstrate the integration philosophy in view of Mechatronics technology

MODULE -1

Introduction: Definition, Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.

Transducers and sensors: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity switches and Hall Effect sensors. 10 Hours

MODULE -2

Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers.

Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data, Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor. 10 Hours

MODULE -3

Programmable logic controller: Introduction to PLC's, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching & selection of a PLC.

Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot. 10 Hours

MODULE -4

Mechanical actuation systems: Mechanical systems, types of motion, Cams, Gear trains, Ratchet & Pawl, belt and chain drives, mechanical aspects of motor selection.

Electrical actuation systems: Electrical systems, Mechanical switches, Solenoids, Relays, DC/AC Motors, Principle of Stepper Motors & servomotors. 10 Hours

MODULE -5

Pneumatic and hydraulic actuation systems: Actuating systems, Pneumatic and hydraulic systems, Classifications of Valves, Pressure relief valves, Pressure regulating/reducing valves, Cylinders and rotary actuators.

DCV & FCV: Principle & construction details, types of sliding spool valve,

solenoid operated, Symbols of hydraulic elements, components of hydraulic system, functions of various units of hydraulic system. Design of simple hydraulic circuits for various applications.

10 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Develop mechanical, hydraulic, pneumatic and electrical control systems.

TEXT BOOKS:

1. NitaigourPremchandMahalik , Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, 1stEdition, 2003 ISBN.No. 0071239243, 9780071239240.
2. W.Bolton-Pearson Education, Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering, 1stEdition, 2005 ISBN No. 81-7758-284-4.

REFERENCE BOOKS:

1. Mechatronics by HMT Ltd. – Tata McGrawHill, 1st Edition, 2000. ISBN:9780074636435.
2. Anthony Esposito, Fluid Power , Pearson Education, 6th Edition, 2011, ISBN No.9789332518544.

E- Learning

- VTU, E- learning

Scheme of Examination:

Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

DESIGN LABORATORY

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design Laboratory	15MEL76	02	1-0-2	80	20	3Hrs

Prerequisites: Knowledge of Dynamics and Machines and Design of Machine Elements

COURSE OBJECTIVES:

Students are expected-

1. To understand the natural frequency, logarithmic decrement, damping ratio and damping.
2. To understand the balancing of rotating masses.
3. To understand the concept of the critical speed of a rotating shaft.
4. To understand the concept of stress concentration using Photo elasticity.
5. To understand the equilibrium speed, sensitiveness, power and effort of Governor.

PART –A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping Co-efficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Determination of critical speed of rotating shaft.
3. Balancing of rotating masses.
4. Determination of fringe constant of Photo-elastic material using Circular disk subjected diametric compression, Pure bending specimen (four point bending)
5. Determination of stress concentration using Photo elasticity for simple components like Plate with hole under tension or bending, circular disk with circular hole under compression, 2-d crane hook.

PART –B

1. Determination of equilibrium speed, sensitiveness, power and effort of Porter/ Proel / Hartnell Governor. (at least one)
2. Determination of pressure distribution in Journal bearing
3. Determination of principle stresses and strain in a member subjected to combined loading using strain rosettes.
4. Determination of stresses in curved beam using strain gauge.
5. Experiments on Gyroscope (Demonstration only)

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. To understand the working principles of machine elements such as Governors, Gyroscopes etc.,
2. To identify forces and couples in rotating mechanical system components.
3. To identify vibrations in machine elements and design appropriate damping methods and to determine the critical speed of a rotating shaft.
4. To measure strain in various machine elements using strain gauges.
5. To determine the minimum film thickness, load carrying capacity, frictional torque and pressure distribution of journal bearing.
6. To determine strain induced in a structural member using the principle of photo-elasticity.

Scheme of Examination:

One question from Part A:	32 Marks
One question from part B:	32 Marks
Viva- Voce:	16 Marks
Total:	80 Marks

Reference Books:

- [1] “Shigley’s Mechanical Engineering Design”, Richards G. Budynas and J. Keith Nisbett, McGraw-Hill Education, 10th Edition, 2015.
- [2] “Design of Machine Elements”, V.B. Bhandari, TMH publishing company Ltd. New Delhi, 2nd Edition 2007.
- [3] “Theory of Machines”, Sadhu Singh, Pearson Education, 2nd Edition, 2007.
- [4] “Mechanical Vibrations”, G.K. Grover, Nem Chand and Bros, 6th Edition, 1996.

COMPTER INTEGRATED MANUFACTURING LAB

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Computer Integrated Manufacturing LAB	15MEL77	02	1-0-2	80	20	3Hrs

Course Objectives:

CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-Codes and M-codes.
CLO2	To educate the students on the usage of CAM packages.
CLO3	To make the students understand the importance of automation in industries through exposure to FMS, Robotics, and Hydraulics and Pneumatics.

Part-A

Manual CNC part programming for 2 turning and 2 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path.

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations.

3 typical simulations to be carried out using simulation packages like: **CademCAMLab-Pro, Master- CAM.**

Program generation using software. Optimize spindle power, torque utilization, and cycle time. Generation and printing of shop documents like process and cycle time sheets, tool list, and tool layouts. Cut the part in single block and auto mode and measure the virtual part on screen.

Post processing of CNC programs for standard CNC control systems like FANUC, SINUMERIC and MISTUBISHI.

Part B

(Only for Demo/Viva voce)

FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

(Only for Demo/Viva voce)

Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs).

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Course Outcomes:

After studying this course, students will be able to:

CLO1	Generate CNC Lathe part program for Turning, Facing, Chamfering, Grooving, Step turning, Taper turning, Circular interpolation etc.
CLO2	Generate CNC Mill Part programming for Point to point motions, Line motions, Circular interpolation, Contour motion, Pocket milling- circular, rectangular, Mirror commands etc.
CLO3	Use Canned Cycles for Drilling, Peck drilling, Boring, Tapping, Turning, Facing, Taper turning Thread cutting etc.
CLO4	Simulate Tool Path for different Machining operations of small components using CNC Lathe & CNC Milling Machine.
CLO5	Use high end CAM packages for machining complex parts; use state of art cutting tools and related cutting parameters; optimize cycle time.
CLO6	Understand & write programs for Robotcontrol;understand the operating principles of hydraulics, pneumatics and electropneumatic systems. Apply this knowledge to automate & improve efficiency of manufacturing.

Scheme for Examination:

Two Questions from Part A - 60 Marks (30 +30)

Viva-Voce - 20 Marks

Total: 80 Marks

Project Work, Phase I

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase I	15MEP78	2	0-3-0	100	-	-

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2015-2016

B.E. Mechanical Engineering

VIII SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week			Examination				Credits
			Lecture	Tutorial	Practical	Duration (Hours)	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15ME81	Operations Research	3	2	0	03	80	20	100	4
2	15ME82	Additive Manufacturing	4	0	0	03	80	20	100	4
3	15ME83X	Professional Elective - V	3	0	0	03	80	20	100	3
4	15ME84	Internship / Professional Practice	Industry Oriented			03	50	50	100	2
5	15ME85	Project Phase – II	-	6	-	03	100	100	200	6
6	15MES86	Seminar	-	4	-	-	-	100	100	1
TOTAL			10	12	-		390	310	700	20

Professional Elective-V	
15ME832	Experimental Stress Analysis

- 1. Core subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/ branch
- 3. Internship / Professional Practice:** To be carried out between 6th& 7th semester vacation or 7th& 8th semester vacation.

OPERATIONS RESEARCH

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Operations Research	15ME81	4	3-2-0	80	20	3 Hrs

Course objectives:

1. To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
2. To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials and machinery.

MODULE -1

Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR,

Linear Programming Problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).

08 Hours

MODULE -2

LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.

12 Hours

MODULE -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems.

Travelling Salesman Problem (TSP). Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.

12 Hours

MODULE -4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models. 10 Hours

MODULE -5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Basic assumptions, Johnson's algorithm, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing of 2 jobs on 'm' machines using graphical method. 08 Hours

Course outcomes:

On completion of this subject, students will be able to:

1. Understand the meaning, definitions, scope, need, phases and techniques of operations research.
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems.
4. Solve problems on game theory for pure and mixed strategy under competitive environment.
5. Solve waiting line problems for M/M/1 and M/M/K queuing models.
6. Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks.
7. Determine minimum processing times for sequencing of n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines using Johnson's algorithm.

TEXT BOOKS:

1. Operations Research, P K Gupta and D S Hira, S. Chand and Company LTD.

Publications, New Delhi – 2007

2. Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.

REFERENCE BOOKS:

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt.Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8thEd., McGraw Hill

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

ADDITIVE MANUFACTURING

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Additive Manufacturing	15ME82	4	4-0-0	80	20	3 Hrs

Course Objectives:

Students will be able to

1. Understand the additive manufacturing process, polymerization and powder metallurgy process
2. Understand characterisation techniques in additive manufacturing.
3. Acquire knowledge on CNC and Automation.

Module 1

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain:** Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, Discrete particle system, Molten material systems and Solid sheet system.

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection

AM Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defence, automobile, Bio-medical and general engineering industries

10 Hours

Module 2

System Drives and devices: Hydraulic and pneumatic motors and their features, Electrical motors AC/DC and their features

Actuators: Electrical Actuators; Solenoids, Relays, Diodes, Thyristors, Triacs, Hydraulic and Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

8 Hours

Module 3

POLYMERS & POWDER METALLURGY

Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality,

12 Hours

	<p>Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD] Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM Powder Production Techniques: Different Mechanical and Chemical methods, Atomisation of Powder, other emerging processes.Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization Microstructure Control in Powder: Importance of Microstructure Study, Microstructures of Powder by Different techniques Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting. Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.</p>	
Module 4		
	<p>NANO MATERIALS & CHARACTERIZATION TECHNIQUES: Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology Nano-materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of Nano-materials- sol-gel process; Gas Phase synthesis of Nano-materials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC). Optical Microscopy - principles, Imaging Modes, Applications, Limitations. Scanning Electron Microscopy (SEM) - principles, Imaging Modes, Applications, Limitations. Transmission Electron Microscopy (TEM) - principles, Imaging Modes, Applications, Limitations.X- Ray Diffraction (XRD) - principles, Imaging Modes, Applications, Limitations.Scanning Probe Microscopy (SPM) - principles, Imaging Modes, Applications, Limitations, Limitations.Atomic Force Microscopy (AFM) - basic principles, instrumentation, operational modes, Applications, Limitations. Electron Probe Micro Analyzer (EPMA) - Introduction, Sample preparation, Working procedure, Applications, Limitations.</p>	10 Hours
Module 5		
	<p>MANUFACTURING CONTROL AND AUTOMATION CNC technology - An overview: Introduction to NC/CNC/DNC machine tools,</p>	10 Hours

	<p>Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC Part programming: CNC programming and introduction, Manual part programming: Basic (Drilling, milling, turning etc.), Special part programming, Advanced part programming, Computer aided part programming (APT)</p> <p>Introduction: Automation in production system principles and strategies of automation, basic Elements of an automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity</p> <p>Control Technologies in Automation: Industrial control system. Process industry vs discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms. Other control system components.</p>	
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Course Outcomes

1. Understand the different process of Additive Manufacturing. using Polymer, Powder and Nano materials manufacturing.
2. Analyse the different characterization techniques.
3. Describe the various NC, CNC machine programing and Automation techniques.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th edition, 2005
3. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
4. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
5. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
6. Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.

REFERENCE BOOKS:

1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000
2. Computer Aided Manufacturing - P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999
3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
4. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.

EXPERIMENTAL STRESS ANALYSIS

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Experimental Stress Analysis	15ME832	3	3-0-0	80	20	3 Hrs

Course Learning Objectives (CLO's):

1. To use the method of electrical strain gauges to study and characterize the elastic behavior of solid bodies.
2. To measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. To describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
4. To determine stress strain behavior of solid bodies using methods of coating.
5. To conduct stress strain analysis of solid bodies using the methods Holography

Module - 1

Introduction: Definition of terms, Calibration, Standards, Dimension and units generalized measurement system. Basic concepts in dynamic measurements, system response, distortion, impedance matching, Analysis of experimental data, cause and types of experimental errors. general consideration in data analysis.

03Hours

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gageconstruction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance' Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

05 Hours

Module -2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

04 Hours

Force, Torque and strain measurements: Mass balance measurement, Elastic element for force measurements, torque measurement.

02 Hours

Module –3

Photoelasticity: Nature of light, Wave theory of light - optical interference, Stress optic law –effect of stressed model in plane and circular polariscopes, Isoclinics&Isochromatics, Fringe order determination Fringe multiplication techniques , Calibration photoelastic model materials

06Hours

Two Dimensional Photoelasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photoelastic model materials, Materials for 2D photoelasticity

02 Hours

Module - 4

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photoelasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

04 Hours

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings

06 Hours

Module –5

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

05Hours

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis, Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

05Hours

Course Outcomes (CO's):

At the end of the course, the student will be able to:

1. Explain characterize the elastic behavior of solid bodies.
2. Describe stress strain analysis of mechanical systems using electrical resistance strain gauges.
3. Discuss skills for experimental investigations an accompanying laboratory course is desirable
4. Discuss experimental investigations by predictions by other methods.
5. Describe various coating techniques.

TEXT BOOKS:

1. "**Experimental Stress Analysis**", Dally and Riley, McGraw Hill.
2. "**Experimental Stress Analysis**". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata Mc Graw Hill.

REFERENCES BOOKS :

1. "**Photoelasticity Vol I and Vol II**", M.M.Frocht, John Wiley & sons.
2. "**Strain Gauge Primer**", Perry and Lissner,
3. "**Photo Elastic Stress Analysis**", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "**Motion Measurement and Stress Analysis**", Dave and Adams,
5. **Holman, Experimental Methods for Engineers**, Tata McGraw-Hill Companies, 7th Edition, New York, 2007.
6. **B. C. Nakra and K. K. Chaudhry**, Instrumentation, Measurement and Analysis, Tata McGraw-Hill Companies, Inc, New York, 7th Edition, 2006.

Scheme of Examination: Two question to be set from each module. Students have to answer five full questions, choosing at least one full question from each module.

Internship/ Professional Practice

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Internship/ Professional Practice	15ME84	2	Industry Oriented	50	50	3 Hrs

Project Work, Phase II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Project Work, Phase II	15MEP85	6	0-6-0	100	100	3 Hrs

Seminar

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Seminar	15MES86	1	0-4-0	100	-	-

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

III SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. / Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT31	Engg. Maths – III	Mathematics	04	--	03	25	100	125
2	10ME32A/10ME32B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME33	Basic Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME34	Mechanics of Materials	Mechanical	04	--	03	25	100	125
5	10ME35	Manufacturing Process I	Mechanical	04	--	03	25	100	125
6	10ME36A/10ME36B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL37A/10MEL37B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL38A/10MEL38B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
III SEMESTER B.E. MECHANICAL				21/24	9	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

IV SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Dept.	Teaching Hours / week		Examination			
				Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	Total marks
1	10MAT41	Engg. Maths – IV	Mathematics	04	--	03	25	100	125
2	10ME42A/10ME42B	Material Sc. & Metallurgy / Mechanical Measurements & Metrology	Mechanical	04	--	03	25	100	125
3	10ME43	Applied Thermodynamics	Mechanical	04	--	03	25	100	125
4	10ME44	Kinematics of Machines	Mechanical	04	--	03	25	100	125
5	10ME45	Manufacturing Process II	Mechanical	04	--	03	25	100	125
6	10ME46A/10ME46B	Computer Aided Machine Drawing / Fluid Mechanics	Mechanical	01 04	03 --	03	25	100	125
7	10MEL47A/10MEL47B	Metallography & Material Testing Lab / Mech. Measurements & Metrology Lab	Mechanical	--	03	03	25	50	75
8	10MEL48A/10MEL48B	Foundry & Forging lab / Machine Shop	Mechanical	--	03	03	25	50	75
				21	09	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

V SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME51	Management and Entrepreneurship	04	--	03	25	100	125
2	10ME52	Design of Machine Elements I	04	--	03	25	100	125
3	10ME53	Energy Engineering	04	--	03	25	100	125
4	10ME54	Dynamics of Machines	04	--	03	25	100	125
5	10ME55	Manufacturing Process III	04	--	03	25	100	125
6	10ME56	Turbo Machines	04	--	03	25	100	125
7	10MEL57	Fluid Mechanics & Machines Lab	--	03	03	25	50	75
8	10MEL58	Energy Conversion Engg. Lab		03	03	25	50	75
			24	06	24	200	700	900

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME61	Computer Integrated Manufacturing	04	--	03	25	100	125
2	10ME62	Design of Machine Elements II	04	--	03	25	100	125
3	10ME63	Heat & Mass Transfer	04	--	03	25	100	125
4	10ME64	Finite Element Methods	04	--	03	25	100	125
5	10ME65	Mechatronics & □ P	04	--	03	25	100	125
6	10ME66X	Elective 'A'	04	--	03	25	100	125
7	10MEL67	Heat & Mass Transfer Lab	--	03	03	25	50	75
8	10MEL68	CAMA Lab	--	03	03	25	50	75
			24	06	24	200	700	900

Elective 'A'	
10ME663 Refrigeration & Air Conditioning	
10ME665 Non Traditional Machining	

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SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME71	Engineering Economics	04	--	03	25	100	125
2	10ME72	Mechanical Vibrations	04	--	03	25	100	125
3	10ME73	Hydraulics and Pneumatics	04	--	03	25	100	125
4	10ME74	Operations Research	04	--	03	25	100	125
5	10ME75X	Elective B	04	--	03	25	100	125
6	10ME76X	Elective C	04	--	03	25	100	125
7	10MEL77	Design Lab	--	03	03	25	50	75
8	10MEL78	CIM and Automation Lab	--	03	03	25	50	75
9	10MEL79	Project Phase I	--	--	--	50	--	50
			24	06	24	250	700	950

Elective 'B'	Elective 'C'
10ME754 Non Conventional Energy Sources	10ME761 Experimental Stress Analysis
10ME758 Total Quality Management	

VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION

VIII SEMESTER B.E. MECHANICAL

S.No.	Sub-Code	Title	Teaching Hours/week		Examination			Total Marks
			Theory	Pract. ./ Drg.	Duration	Max. I.A. Marks	Max. Theory /Pr.	
1	10ME81	Operations Management	04	--	03	25	100	125
2	10ME82	Control Engineering	04	--	03	25	100	125
3	10ME83X	Elective D	04	--	03	25	100	125
4	10ME84X	Elective E	04	--	03	25	100	125
5	10ME85L	Project Work	--	06	03	100	100	200
6	10ME86L	Seminar	--	03	--	50	--	50
				09	15	250	500	750

Elective 'D'	Elective 'E'
10ME831 Tribology	10ME844Automotive Engineering
10ME833 Power Plant Engineering	
10ME838 Foundry Technology	

III Semester
MATERIAL SCIENCE AND METALLURGY

Sub Code	: 10ME 32A /42A	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT - 2

Mechanical Behaviour: Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, ductility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT - 3

Fracture: Type I, Type II and Type III.

Creep: Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

07 Hours

UNIT - 4

Solidification: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT - 5

Phase Diagram II: Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT - 6

Heat treating of metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT - 7

Ferrous and non ferrous materials: Properties, Composition and uses of

- Grey cast iron, malleable iron, SG iron and steel
- Copper alloys-brasses and bronzes.
Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT - 8

Composite Materials: Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering**, Smith, 4th Edition McGraw Hill, 2009
2. **Materials Science, Shackelford., & M. K. Muralidhara**, Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An Introduction to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering**, V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering**, H. VanVlack, Addison-Wesley Edn., 1998
6. **Materials Science and Engineering**, William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. **The Science and Engineering of Materials**, Donald R. Asklund and Pradeep.P. Phule, Cengage Learning, 4th Ed., 2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	: 10ME 32B / 42B	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT-1:

Standards of measurement: Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2:

System of Limits, Fits, Tolerance and Gauging: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3:

Comparators and Angular measurement: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4:

Interferometer and screw thread, gear measurement: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2 - wire and 3 - wire methods, best size wire. Tool maker's microscope, gear tooth terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5:

Measurements and measurement systems: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **07 Hours**

UNIT-6:

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters. **06 Hours**

UNIT-7:

Measurement of force, torque and pressure: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge. **06 Hours**

UNIT-8:

Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. **07 Hours**

TEXT BOOKS:

1. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. **Mechanical Measurements**, R.K. Jain Khanna Publishers, 1994
3. **Industrial Instrumentation**, Alstuko, Jerry. D. Faulk, Cengage Asia Pvt. Ltd. 2002.
4. **Measurement Systems Applications and Design**, Ernest O. Doebelin, 5th Ed., McGraw Hill Book Co.
5. **Metrology & Measurement**, Anand K. Bewoor & Vinay A.

BASIC THERMODYNAMICS

(Common to ME/IP/AU/IM/MA)

Sub Code	: 10ME33	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT- 1

Fndamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.

06 Hours

UNIT- 2

Work and Heat: Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

06 Hours

UNIT- 3

First Law of Thermodynamics: Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

07 Hours

UNIT - 4

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat

engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

07 Hours

PART-B

UNIT- 5

Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT- 6

Pure Substances: P-T and P-V diagrams, triple point and critical points. Subcooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT- 7

Thermodynamic relations: Maxwell relation, Clausius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and particular gas constants, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT- 8

Ideal gas mixture : Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart

06 Hours

Data Handbooks :

1. **Thermodynamic data hand book**, B.T. Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOKS:

1. **Basic Engineering Thermodynamics**, A.Venkatesh, University Press, 2008
2. **Basic and Applied Thermodynamics**, P.K.Nag, 2nd Ed., Tata McGraw Hill Pub. 2002

REFERENCE BOOKS:

1. **Thermodynamics**, An Engineering Approach, Yunus A.Cengel and Michael A.Boles, Tata McGraw Hill publications, 2002
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Classical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamics**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna, Swati B. Wadavadagi “Basic Thermodynamics**, PHI, New Delhi, 2010

MECHANICS OF MATERIALS

Sub Code	: 10ME34	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks:	100

PART-A

UNIT 1:

Simple Stress and Strain: Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2:

Stress in Composite Section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3:

Compound Stresses: Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods: Work and strain energy, Strain energy in bar/beams, Castigliano's theorem, Energy methods.

Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lamé's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5:

Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6:

Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / notched beams not included).

07 Hours

UNIT 7:

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:

Torsion of Circular Shafts and Elastic Stability of Columns :

Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. "**Mechanics of Materials**", by R.C.Hibbeler, Prentice Hall. Pearson Edu., 2005
2. "**Mechanics of materials**", James.M.Gere, Thomson, Fifth edition 2004.
3. "**Mechanics of materials**", in SI Units, Ferdinand Beer & Russell Johnston, 5th Ed., TATA McGraw Hill- 2003.

REFERENCE BOOKS:

1. "**Strength of Materials**", S.S. Rattan, Tata McGraw Hill, 2009
2. "**Strength of Materials**", S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. "**Mechanics of Materials**", K.V. Rao, G.C. Raju, First Edition, 2007
4. "**Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. "**Strength of Materials**", W.A. Nash, 5th Ed., Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

(FUNDAMENTALS OF FOUNDRY & WELDING)

Sub Code	: 10ME35	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

CASTING PROCESS

UNIT 1

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.
Additives: Need, Types of additives used and their properties..

06 Hours

UNIT 2

Sand Moulding : Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.

Concept of Gating & Risers. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3

Special moulding Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO₂ mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

07 Hours

UNIT 4

Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding (**MAW**), Flux Shielded Metal Arc Welding (**FSMAW**), Inert Gas Welding (**TIG & MIG**) Submerged Arc Welding (**SAW**) and Atomic Hydrogen Welding processes. (**AHW**)

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07

Hours

UNIT 6

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7

Metallurgical aspect, in welding : Structure of welds, Formation of different zones during welding. Heat affected zone (**HAZ**). Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8

Principles of soldering & brazing: Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. “**Manufacturing Process-I**”, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. “**Manufacturing & Technology: Foundry Forming and Welding**”, P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. “**Process and Materials of Manufacturing**”, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
2. “**Manufacturing Technology**”, Serope Kalpakjain, Steuen. R. Sechmid, Pearson Education Asia, 5th Ed. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code	: 10ME36A / 10ME46A	IA Marks	: 25
Hrs/week	: 04(1 Hrs. Theory & 2 Hrs Practical)	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Introduction:

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.

02 Hours

PART-A

UNIT 1:

Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections.

Orthographic Views: Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.

08 Hours

UNIT 2:

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

08 Hours

PART-B

UNIT 3:

Keys & Joints :

Parallel key, Taper key, Feather key, Gibhead key and Woodruff key

Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

08 Hours

UNIT 4:

Couplings:

Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

08 Hours

PART - C

Assembly Drawings

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice
7. Tool Head of a shaper

18 Hours

TEXT BOOKS:

1. 'A Primer on Computer Aided Machine Drawing-2007', Published by VTU, Belgaum.
2. 'Machine Drawing', N.D.Bhat & V.M.Panchal

REFERENCE BOOKS:

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication.
3. 'Machine Drawing with Auto CAD', Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
4. 'Auto CAD 2006, for engineers and designers', Sham Tickoo. Dream tech 2005
5. 'Machine Drawing', N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill,2006

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e. PART-A	1 x 20 = 20 Marks
PART-B	1 x 20 = 20 Marks
PART-C	1 x 60 = 60 Marks
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Total	= 100 Marks

FLUID MECHANICS

Sub Code	: 10ME 36B / 46B	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	100

PART – A

UNIT-1

Properties of Fluids: Introduction, Types of fluid, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2

Fluid Statics : Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3

Buoyancy and Fluid Kinematics:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.

Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5

Fluid Flow Measurements : Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similitudes.

07 Hours

UNIT-6

Flow through pipes : Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

06 Hours

UNIT-7

Laminar flow and viscous effects : Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseuille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.

Introduction to compressible flow : Velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. **Fluid Mechanics**, Ojush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. **Fluid Mechanics**, Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. **Fluid Mechanics and hydraulics**, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. **Fluid Mechanics (SI Units)**, Yunus A. Cengel John M.Oimbala, 2nd Ed., Tata McGraw Hill, 2006.

3. **Fluid Mechanics**, John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. **Fluid Mechanics and Fluid Power Engineering**, Kumar.D.S, Kataria and Sons., 2004
5. **Fluid Mechanics** - . Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	: 10MEL 37A / 47A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
 - (a). Ultrasonic flaw detection
 - (b). Magnetic crack detection
 - (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S, C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	: 10MEL 37B / 47B	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from part -A: 20 Marks

ONE question from part -B: 20 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

FOUNDRY AND FORGING LABORATORY

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

- 1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
- 2 Permeability test
- 3 Core hardness & Mould hardness tests.
- 4 Sieve Analysis to find Grain Finest number of Base Sand
- 5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.

Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations :

- Calculation of length of the raw material required to do the model.

- Preparing minimum three forged models involving upsetting, drawing and bending operations.
- Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks
Calculation (Forging)	+ Forging Model	= 05 +25 = 30 Marks

Viva-Voce : 10 marks.

Total : 50 Marks.

MACHINE SHOP

Sub Code	: 10MEL 38A / 48A	IA Marks	: 25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 48	Exam Marks	: 50

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.
Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

ONE question from part -A: 30 Marks

ONE question from part -B: 10 Marks

Viva -Voice: 10 Marks

Total : 50 Marks

APPLIED THERMODYNAMICS

Sub Code	: 10ME43	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

Unit 1:

Combustion thermodynamics: Theoretical (Stoichiometric) air and excess air for combustion of fuels. Mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency, adiabatic flow temperature.

07 Hours

Unit 2:

Gas power cycle: Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparison of Otto, Diesel and dual cycles.

06 Hours

Unit 3:

I.C. Engine: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

06 Hours

Unit 4:

Vapour Power Cycles: Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5:

Reciprocating Compressors: Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work,

optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6:

Gas turbine and Jet propulsion: Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7

Refrigeration: Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8

Psychrometry: Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two enthalpy and adiabatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

Data Hand Book :

1. **Thermodynamic data hand book**, B.T.Nijaguna.
2. **Properties of Refrigerant & Psychometric** (tables & Charts in SI Units), Dr. S.S. Banwait, Dr. S.C. Laroia, Birla Pub. Pvt. Ltd., Delhi, 2008

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, 2nd Ed., Tata McGraw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkahna, Swati B. Wadavadagi, PHI, New Delhi, 2010

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cengel and Michael A.Boies, 6th Ed., Tata McGraw Hill pub. Co., 2002,

2. **Fundamental of Classical Thermodynamics**, G.J. Van Wylen and R.E. Sontang Wiley eastern.

KINEMATICS OF MACHINES

Sub Code	: 10ME44	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1:

Introduction: Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2:

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3:

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5:

Velocity and Acceleration Analysis of Mechanisms (Analytical Methods):

Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6:

Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:

Gear Trains: Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:

Cams: Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines"**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines"**, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambekar, PHI, 2007

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II

(Metal Removing Process)

Sub Code	: 10ME45	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT - 1

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation, Types of Chips. Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07

Hours

UNIT - 2

Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.

07 Hours

UNIT - 3

Turning (Lathe), Shaping and Planing Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machining time calculations

07 Hours

UNIT - 4

Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials. Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours

PART – B

UNIT - 5

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.

Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours

UNIT - 6

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.

07 Hours

UNIT - 7:

Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.

Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours

UNIT - 8

Non-traditional machining processes: Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology**, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology**, R.K.Jain, Khanna Publications, 2003.
3. **Production Technology**, HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools**, G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	: 10AL 51	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization - Principles of organization - Types of organization - Departmentation - Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co - Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINE ELEMENTS-I

Sub Code	: 10ME 52	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT- 1

Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

05 Hours

UNIT- 2

Design For Static & Impact Strength:

Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

07 Hours

UNIT - 3

Design For Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

08 Hours

UNIT - 4

Threaded Fasteners: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

06 Hours

PART - B

UNIT - 5

Design Of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

07 Hours

UNIT - 6

Cotter And Knuckle Joints, Keys And Couplings: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and

flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

07 Hours

UNIT - 7

Riveted and Welded Joints – Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

07 Hours

UNIT - 8

Power Screws: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

05 Hours

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2009.
2. **Design of Machine Elements**, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

DESIGN DATA HANDBOOK

1. **Design Data Hand Book**, K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

REFERENCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design**, Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

ENERGY ENGINEERING

Sub Code	: 10ME 53	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Steam Power Plant: Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures.

07 Hours

UNIT - 2

A Brief Account Of Benson, Velox Schmidt Steam Generators. Chimneys: Natural, forced, induced and balanced draft, Calculations and numericals involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Superheaters, De-superheater, control of superheaters, Economizers, Air pre-heaters and re-heaters.

07 Hours

UNIT - 3

Diesel Engine Power Plant: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.

06 Hours

UNIT - 4

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numericals. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.

06 Hours

PART - B

UNIT - 5

Nuclear Power Plant: Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio active waste disposal.

06 Hours

UNIT - 6

Solar Energy: Solar Extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples).

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor (Numerical Examples).

08 Hours**UNIT - 7**

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC.

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy.

06 Hours**UNIT - 8**

Energy From Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation.

Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, classification of bio gas plants, factors affecting bio gas generation.

Thermo Chemical Route: Thermo chemical conversion on bio mass, types of gasifiers.

06 Hours**TEXT BOOKS:**

1. **Power Plant Engineering**, P. K. Nag Tata McGraw Hill 2nd edn 2001.
2. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons. 2003

REFERENCE BOOKS:

1. **Power Plant Engineering**, R. K. Rajput, Laxmi publication, New Delhi.
2. **Principles of Energy conversion**, A. W. Culp Jr., McGraw Hill. 1996

3. **Non conventional Energy sources**, G D Rai Khanna Publishers.
4. **Non conventional resources**, B H Khan TMH - 2007

DYNAMICS OF MACHINES

Sub Code	: 10ME 54	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1: Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

06 Hours

UNIT 2: Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

08 Hours

UNIT 3: Friction and Belt Drives: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives. ratio of belt tensions, centrifugal tension, power transmitted.

06 Hours

UNIT 4: Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

06 Hours

PART - B

UNIT 5: Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

08 Hours

UNIT 6: Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force. stability, sensitiveness. Isochronism, effort and power,

06 Hours

UNIT 7: Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

06 Hours

UNIT 8: Analysis of Cams: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers. Undercutting in Cams

06 Hours

TEXT BOOKS:

1. **Theory of Machines**, Sadhu Singh, Pearson Education. 2nd edition. 2007.
2. **Theory of Machines**, Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms"**, J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009
2. **Mechanism and Machine Theory**, A.G.Ambekar PHI, 2007

MANUFACTURING PROCESS – III

(METAL FORMING PROCESS)

Sub Code	: 10ME 55	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction And Concepts: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain, triaxial & biaxial stresses. Determination of flow stress. Principal stresses, Tresca & Von-Mises yield criteria, concepts of plane stress & plane strain.

07 Hours

UNIT - 2

Effects Of Parameters: Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

06 Hours

UNIT - 3

Forging: Classification of forging processes. Forging machines & equipment. Expressions for forging pressures & load in open die forging and closed die forging by slab analysis, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Simple problems.

07 Hours**UNIT - 4**

Rolling: Classification of Rolling processes. Types of rolling mills, expression for Rolling load. Roll separating force. Frictional losses in bearing, power required in rolling, Effects of front & back tensions, friction, friction hill. Maximum possible reduction. Defects in rolled products. Rolling variables, simple problems.

06 Hours**PART - B****UNIT - 5**

Drawing: Drawing equipment & dies, expression for drawing load by slab analysis, power requirement. Redundant work and its estimation, optimal cone angle & dead zone formation, drawing variables, Tube drawing, classification of tube drawing, simple problems.

07 Hours**UNIT - 6**

Extrusion: Types of extrusion processes, extrusion equipment & dies, deformation, lubrication & defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, simple problem

06 Hours**UNIT - 7**

Sheet & Metal Forming: Forming methods, dies & punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, Forming limit criterion, defects of drawn products, stretch forming. Roll bending & contouring, Simple problems

06 Hours**UNIT - 8**

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming, Electromagnetic forming.

Powder Metallurgy: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations.

07 Hours**TEXT BOOKS:**

1. **Mechanical metallurgy (SI units)**, G.E. Dieter, Mc Graw Hill pub.2001
2. **Manufacturing Process – III**, Dr. K.Radhakrishna, Sapna Book House, 2009.

REFERENCE BOOKS:

1. **Materials and Processes in Manufacturing**, E.paul, Degramo, J.T. Black, Ronald, A.K. Prentice -hall of India 2002
2. **Principles of Industrial metal working process**, G.W. Rowe, CBSpub. 2002
3. **Manufacturing Science**, Amitabha Ghosh & A.K. Malik - East - Westpress 2001
4. **Technology of Metal Forming Process**, Surendra kumar, PHI – 2008

TURBO MACHINES

Sub Code	: 10ME 56	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Definition of turbomachine, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynold's number, Unit and specific quantities, model studies. Application of first and second law's of thermodynamics to turbomachines, Efficiencies of turbomachines. Problems.

07 Hours

UNIT – 2

Thermodynamics of fluid flow: Static and Stagnation states-Incompressible fluids and perfect gases, Overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

07 Hours

UNIT – 3

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction,

utilization factor, Relation between degree of reaction and Utilization factor, Problems.

06 Hours

UNIT – 4

General Analysis of Turbomachines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

06 Hours

PART - B

UNIT – 5

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor, Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging, Problems.

07 Hours

UNIT – 6

Hydraulic Turbines: Classification, Different efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency. Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

07 Hours

UNIT – 7

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

06 Hours

UNIT – 8

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

06 Hours

(Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

TEXT BOOKS:

1. **An Introduction to Energy Conversion**, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
2. **Turbines, Compressors & Fans**, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002

REFERENCE BOOKS:

1. **Principals of Turbomachines**, D. G. Shepherd, The Macmillan Company (1964).
2. **Fluid Mechanics & Thermodynamics of Turbomachines**, S. L. Dixon, Elsevier (2005).
3. **Turbomachine**, B.K.Venkanna PHI, New Delhi 2009.
4. **Text Book of Turbomachines**, M. S. Govindgouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008.

FLUID MECHANICS AND MACHINES LABORATORY

Sub Code	: 10MEL 57	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of coefficient of friction of flow in a pipe.
2. Determination of minor losses in flow through pipes.
3. Determination of force developed by impact of jets on vanes.
4. Calibration of flow measuring devices
 - a. Orifice Plate meter
 - b. Nozzle
 - c. Venturimeter
 - d. V-notch

18 Hours

PART - B

5. Performance testing of Turbines
 - a. Pelton wheel
 - b. Francis Turbine
 - c. Kaplan Turbines
6. Performance testing of Pumps
 - a. Single stage / Multi stage centrifugal pumps
 - b. Reciprocating pump
7. Performance test of a two stage Reciprocating Air Compressor
8. Performance test on an Air Blower

24 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup + 10)
One Question from Part B	-	25 Marks (05 Writeup + 20)
Viva-Voce	-	10 Marks

Total		50 Marks

ENERGY CONVERSION ENGINEERING LABORATORY

Sub Code	: 10MEL 58	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.

4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).
5. Use of planimeter

21 Hours**PART - B**

1. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio heat balance sheet for
 - (a) Four stroke Diesel Engine
 - (b) Four stroke Petrol Engine
 - (c) Multi Cylinder Diesel/Petrol Engine, (Morse test)
 - (d) Two stroke Petrol Engine
 - (e) Variable Compression Ratio I.C. Engine.

21 Hours**Scheme for Examination:**

One Question from Part A	-	15 Marks (05 Writeup+10)
One Question from Part B	-	25 Marks (05 Writeup+20)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER INTEGRATED MANUFACTURING

Sub Code	: 10ME 61	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT - 1

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Transfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

6 Hours

UNIT - 4

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering L above methods and computerized line balancing.

6 Hours

PART-B

UNIT - 5

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly Machine analysis of single station assembly. **Automated Guided Vehicle System:** Introduction,

Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.

6 Hours

UNIT - 7

Cnc Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

6 Hours

UNIT - 8

Robotics: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

2. **Automation, Production system & Computer Integrated manufacturing**, M. P. Groover Person India, 2007 2nd edition.
3. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing**, J. A. Rehg & Henry. W. Kraebber.
2. **CAD/CAM** by Zeid, Tata McGraw Hill.

DESIGN OF MACHINE ELEMENTS – II

Sub Code	: 10ME 62	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Cylinders & Cylinder Heads: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

08 Hours

UNIT - 2

Belts Ropes and Chains: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

05 Hours**UNIT - 3**

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

08 Hours**UNIT - 4**

Spur & Helical Gears: Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load. Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

07 Hours**PART - B****UNIT - 5**

Bevel and Worm Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

07 Hours**UNIT - 6**

Clutches & Brakes: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

05 Hours**UNIT - 7**

Lubrication and Bearings: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

07 Hours**UNIT - 8**

IC Engine Parts: Design of piston, connecting rod and crank shaft.

05 Hours**DESIGN DATA HANDBOOK**

1. **Design Data Hand Book** , K. Lingaiah, McGraw Hill, 2nd Ed.
2. **Data Hand Book**, K. Mahadevan and Balaveera Reddy, CBS Publication

3. **Design Data Hand Book**, H.G. Patil, I. K. International Publisher, 2010.

TEXT BOOKS

1. **Mechanical Engineering Design**, Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements**, V. B Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007

REFERNCE BOOKS

1. **Machine Design**, Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements**, M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.
3. **Machine Design**, Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design**, A CAD Approach: Andrew D DIMAROGONAS, John Wiley Sons, Inc, 2001.

HEAT AND MASS TRANSFER

Sub Code	: 10ME 63	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introductory Concepts And Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism. Boundry conditions of 1st, 2nd and 3rd Kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance.

07 Hours

UNIT - 2

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept & its importance. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hours**UNIT - 3**

One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems.

06 Hours**UNIT - 4**

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

07 Hours**PART - B****UNIT - 5**

Forced Convections: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

06 Hours**UNIT - 6**

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hours

UNIT - 7

Condensation And Boiling: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling, pool boiling correlations. Numerical problems. Mass transfer definition and terms used in mass transfer analysis, Ficks First law of diffusion (no numericals).

07 Hours**UNIT - 8**

Radiation Heat Transfer: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hours**TEXT BOOKS:**

1. **Heat & Mass transfer**, Tirumaleshwar, Pearson education 2006
2. **Heat transfer-A basic approach**, Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach**, Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer**, Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer**, Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer**, P.K. Nag, Tata McGraw Hill 2002.

FINITE ELEMENT METHODS

Sub Code	: 10ME 64	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART-A

UNIT-1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

UNIT-2

Basic Procedure: Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

UNIT-3

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

UNIT-4

Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique.

06 Hrs

PART-B

UNIT-5

Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

UNIT-6

Trusses: Stiffness matrix of Truss element. Numerical problems.

06 Hrs

UNIT-7

Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.

06 Hrs

UNIT-8

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs**TEXT BOOKS:**

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

MECHATRONICS & MICROPROCESSOR

Sub Code	: 10ME 65	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A**UNIT - 1**

Introduction to Mechatronic Systems: Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours**UNIT - 2**

Review of Transducers and Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours

UNIT 3

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

06 Hours**UNIT - 4**

Signal Conditioning: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system. Processing Pulse-modulation.

07 Hours**PART - B****UNIT - 5**

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

07 Hours**UNIT - 6**

Logic Function: Data word representation. Basic elements of control systems 808SA processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

07 Hours**UNIT - 7**

Organization & Programming of Microprocessors: Introduction to organization of INTEL 808S-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

06 Hours**UNIT - 8**

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

06 Hours

TEXT BOOKS:

1. **Mechatronics**, W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming And Applications With 8085/8085A**, R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics and Microprocessors**, K.P.Ramchandran, G.K.Vijayraghavan, M.S.Balasundran, Wiley, 1st Ed, 2009
2. **Mechatronics - Principles, Concepts and applications** – Nitaigour and Premchand Mahilik - Tata McGraw Hill- 2003.
3. **Mechatronics Principles & applications**, Godfrey C. Onwubolu, Elsevier..
4. **Introduction Mechatronics & Measurement systems**, David.G. Aliciatore & Michael. B. Bihistaned, Tata McGraw Hill, 2000.

HEAT & MASS TRANSFER LABORATORY

Sub Code	: 10MEL 67	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. Determination of Effectiveness on a Metallic fin.
4. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
5. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
6. Determination of Emissivity of a Surface.

21 Hours**PART - B**

1. Determination of Stefan Boltzman Constant.
2. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers
3. Experiments on Boiling of Liquid and Condensation of Vapour

4. Performance Test on a Vapour Compression Refrigeration.
5. Performance Test on a Vapour Compression Air - Conditioner
6. Experiment on Transient Conduction Heat Transfer

21 Hours**Scheme for Examination:**

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

COMPUTER AIDED MODELING AND ANALYSIS LABORATORY

Sub Code	: 10MEL 68	IA Marks	25
Hrs/week	: 03	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A**Study of a FEA package and modeling stress analysis of**

- a. Bars of constant cross section area, tapered cross section area and stepped bar
6 Hours
- b. Trusses – (Minimum 2 exercises)
3 Hours
- c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc (Minimum 6 exercises)
12 Hours

PART - B

- a) Stress analysis of a rectangular plate with a circular hole
3 Hours
- b) Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 4 exercises)
9 Hours

- c) Dynamic Analysis
- 1) Fixed – fixed beam for natural frequency determination
 - 2) Bar subjected to forcing function
 - 3) Fixed – fixed beam subjected to forcing function

9 Hours

REFERENCE BOOKS:

1. **A first course in the Finite element method**, Daryl L Logan, Thomason, Third Edition
2. **Fundamentals of FEM**, Hutton – McGraw Hill, 2004
3. **Finite Element Analysis**, George R. Buchanan, Schaum Series

Scheme for Examination:

One Question from Part A	-	20 Marks (05 Write up +15)
One Question from Part B	-	20 Marks (05 Write up +15)
Viva-Voce	-	10 Marks

Total		50 Marks

ELECTIVE-II (GROUP - A)

REFRIGERATION AND

AIR CONDITIONING

Sub Code	: 10ME 663	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Methods Of Refrigeration: Ice refrigeration, evaporative refrigeration, air refrigeration, vapour refrigeration, dry ice refrigeration, thermo electric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration.

06 Hours

UNIT – 2

Gas Cycle Refrigeration: Introduction , reverse Carnot cycle, Bell Coleman cycle, advantages & dis-advantages of gas refrigeration system. Applications to aircraft refrigeration, Analysis of gas refrigeration and Numericals.

06 Hours

UNIT – 3

Multi Pressure Vapour Compression Systems: Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid

carbon dioxide, System practices for multistage system.

07 Hours

UNIT - 4

Refrigerants: Types of Refrigerants, Comparative study of Ethane and Methane derivatives, selection of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures

07 Hours

PART - B

UNIT – 5

Equipments Used In Vapour Compression Refrigeration System: Compressors: Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

06 Hours

UNIT - 6

Vapour Absorption System: Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water - Lithium Bromide absorption chiller.

07 Hours

UNIT - 7

Design Conditions: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

Load Calculations And Applied Psychometrics: Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

07 Hours**UNIT - 8**

Transmission And Distribution Of Air: Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

Controls In Refrigeration And Air Conditioning Equipments: High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

06 Hours**TEXT BOOKS:**

1. **‘Refrigeration and Air-Conditioning’** C. P. Arora, Tata McGraw Hill Publication, 2nd edition, 2001.
2. **‘Refrigeration and Air-Conditioning’** W. F. Stoecker, Tata McGraw Hill Publication, 2nd edition, 1982.
3. **ASHRAE**, Hand Book, 2009

REFERENCE BOOKS:

1. **‘Principles of Refrigeration’** Dossat, Pearson-2006.
2. **„Heating, Ventilation and Air Conditioning’**, McQuiston, Wiley Students edition, 5th edition 2000.
3. **„Air conditioning’** PITA, 4th edition, pearson-2005
4. **‘Refrigeration and Air-Conditioning’** Manohar prasad
5. **‘Refrigeration and Air-Conditioning’** S C Arora & S Domkundwar, Dhanpat Rai Publication

NON-TRADITIONAL MACHINING

Sub Code	: 10ME 665	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: History, Classification, comparison between conventional and Non-conventional machining process selection.

05 Hours

UNIT - 2

Ultrasonic Machining (Usm): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hours

UNIT - 3

Abrasive Jet Machining (Ajm): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

07 Hours

UNIT - 4

Electrochemical Machining (Ecm): Introduction, study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

06 Hours

PART - B**UNIT - 5**

Chemical Machining (Chm): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

06 Hours**UNIT - 6**

Electrical Discharge Machining (Edm): Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

08 Hours**UNIT - 7**

Plasma Arc Machining (Pam): Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hours**UNIT - 8**

Laser Beam Machining (Lbm): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (Ebm): Principles, equipment, operations, applications, advantages and limitation of EBM.

07 Hours**TEXT BOOKS:**

1. **Modern machining process**, Pandey and Shan, Tata McGraw Hill 2000
2. **New Technology**, Bhattacharya 2000

REFERENCE BOOKS:

1. **Production Technology**, HMT Tata McGraw Hill. 2001

2. **Modern Machining Process**, Aditya. 2002
3. **Non-Conventional Machining**, P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook: Machining Volume 16**, Joseph R. Davis (Editor), American Society of Metals (ASM)

ENGINEERING ECONOMY

Sub Code	: 10ME 71	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision, Maze. Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion.

08 Hours

UNIT - 2

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present-worth, Assets with unequal lives, infinite lives, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems.

06 Hours

UNIT - 3

Equivalent Annual-Worth Comparisons: Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems.

06 Hours

UNIT - 4

Rate-Of-Return Calculations And Depreciation: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

06 Hours

PART - B

UNIT - 5

Estimating and Costing: Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.

05 Hours

UNIT - 6

Introduction, Scope Of Finance, Finance Functions: Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account. Simple Numericals

08 Hours

UNIT - 7

Financial Ratio Analysis: Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis. Simple numericals

06 Hours

UNIT - 8

Financial And Profit Planning: Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting. Introduction to Bench Marking of Manufacturing Operation.

07 Hours

TEXT BOOKS:

1. **Engineering Economy**, Riggs J.L., 4TH ed. , McGraw Hill, 2002
2. **Engineering Economy**, Thuesen H.G. PHI , 2002

REFERENCE BOOKS:

1. **Engineering Economy**, Tarachand, 2000.
2. **Industrial Engineering and Management**, OP Khanna, Dhanpat Rai & Sons. 2000
3. **Financial Mangement**, Prasanna Chandra, 7th Ed., TMH, 2004
4. **Finacial Management**, IM PANDEY, Vikas Pub. House, 2002

MECHANICAL VIBRATIONS

Sub Code	: 10ME 72	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations**, S. S. Rao, Pearson Education Inc, 4th edition, 2003.
2. **Mechanical Vibrations**, V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications**, W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.
2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.
4. **Mechanical Vibrations**, G. K.Grover, Nem Chand and Bros, 6th edition, 1996.

HYDRAULICS AND PNEUMATICS

Sub Code	: 10ME 73	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT -1

Introduction to Hydraulic Power: Definition of hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law.

The source of Hydraulic Power: Pumps Classification pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump Selection factors, problems on pumps.

07 Hours

UNIT -2

Hydraulic Actuators and Motors: Classification cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems on cylinders, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Theoretical Torque, Power and Flow Rate, Hydraulic Motor Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

06 Hours

UNIT - 3

Control Components in Hydraulic Systems: Classification of control valves, Directional Control Valves- Symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct operated types and pilot operated types. Flow Control Valves - compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

07 Hours

UNIT - 4

Hydraulic Circuit Design And Analysis: Control of Single and Double - Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

06 Hours

PART – B

UNIT - 5

Maintenance of Hydraulic System: Hydraulic Oils - Desirable properties, general type of Fluids, Sealing Devices, Reservoir System, Filters and Strainers, wear of Moving Parts due to solid -particle Contamination, temperature control (heat exchangers), Pressure switches, trouble shooting.

06 Hours

UNIT - 6

Introduction to Pneumatic Control: Definition of pneumatic system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit.

Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

07 Hours

UNIT-7

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. 3Hrs Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and Exhaust air throttling and Exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependant controls- types - construction - practical applications, Time dependent controls principle. Construction, practical applications.

07 Hours

UNIT-8

Multi- Cylinder Application: Coordinated and sequential motion control, Motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and out put, pilot assisted solenoid control of directional control valves, Use of relay and contactors. Control circuitry for simple signal cylinder application.

Compressed Air: Production of compressed air- Compressors Preparation of compressed air-Driers, Filters, Regulators, Lubricators, Distribution of compressed air Piping layout.

06 Hours

TEXT BOOKS:

1. **“Fluid Power with Applications”**, Anthony Esposito, Sixth edition, Pearson Education, Inc, 2000.
2. **'Pneumatics and Hydraulics'**, Andrew Parr, Jaico Publishing Co

REFERENCE BOOKS:

1. **'Oil Hydraulic systems', Principles and Maintenance** S. R. Majurr, Tata McGraw Hill Publishing Company Ltd. - 2001
2. **'Industrial Hydraulics', Pippenger, Hicks'** McGraw Hill, New York
3. **'Hydraulic & Pneumatic Power for Production'**, Harry L. Stewart
4. **'Pneumatic Systems'**, S. R. Majumdar, Tata McGraw Hill Publish 1995
5. **Power Hydraulics'** Michael J Pinches & John G Ashby, Prentice Hall

OPERATION RESEARCH

Sub Code	: 10ME 74	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART- A

UNIT -1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method.

04 Hours

UNIT -2

Solution Of Linear Programming Problems: The simplex method-canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

08 Hours

UNIT -3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

08 Hours

UNIT -4

Integer Programming: Pure and mixed integer programming problems, solution of Integer programming problems-Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-One programming.

06 Hours

PART- B

UNIT -5

Pert-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

08 Hours

UNIT -6

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models and their steady state performance analysis.

06 Hours

UNIT -7

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

06 Hours

UNIT -8

Sequencing: Basic assumptions, sequencing „n“ jobs on single machine using priority rules, sequencing using Johnson“s rule-„n“ jobs on 2 machines, „n“ jobs on 3 machines, „n“ jobs on „m“ machines. Sequencing 2 jobs on „m“ machines using graphical method.

06 Hours

TEXT BOOKS

1. **Operations Research**, P K Gupta and D S Hira, Chand Publications, New Delhi - 2007
2. **Operations Research**, Taha H A, Pearson Education

REFERNCE BOOKS

1. **Operations Research**, A P Verma, S K Kataria & Sons, 2008
2. **Operations Research**, Paneerselvan, PHI
3. **Operations Research**, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. **Introduction to Operations Research**, Hillier and Liberman, 8th Ed., McGraw Hill
5. **Operations Research** S.D. Sharma, Ledarnath Ramanath & Co, 2002

DESIGN LABORATORY

Sub Code	: 10MEL 77	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

1. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2. Balancing of rotating masses.
3. Determination of critical speed of a rotating shaft.
4. Determination of Fringe constant of Photoelastic material using.
 - a) Circular disc subjected to diametral compression.
 - b) Pure bending specimen (four point bending)
5. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.

PART - B

6. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (only one or more)
7. Determination of Pressure distribution in Journal bearing.
8. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
9. Determination of stresses in Curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only)

Scheme of Examination:

One question from Part A -	20 Marks (05 Write up +15)
One question from Part B -	20 Marks (05 Write up +15)
Viva - Voce -	10 Marks

Total: 50 Marks

CIM & AUTOMATION LAB

Sub Code	: 10MEL 78	IA Marks	25
Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 42	Exam Marks	: 50

PART - A

CNC part programming using CAM packages. Simulation of Turning, Drilling, Milling operations. 3 typical simulations to be carried out using simulation packages like Master- CAM, or any equivalent software.

PART - B

(Only for Demo/Viva voce)

1. FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.
2. Robot programming: Using Teach Pendant & Offline programming to perform pick and place, stacking of objects, 2 programs.

PART - C

(Only for Demo/Viva voce)

Pneumatics and Hydraulics, Electro-Pneumatics: 3 typical experiments on Basics of these topics to be conducted.

Scheme of Examination:

Two questions from Part A - 40 Marks (20 Write up +20)
Viva - Voce - 10 Marks

Total: 50 Marks

NON-CONVENTIONAL ENERGY RESOURCE

Sub Code	: 10ME 754	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

Subject Code	:	10ME754	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART - A

Will be sent Letter

TOTAL QUALITY MANAGEMENT

Sub Code	: 10ME 758	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM.

06 Hours

UNIT - 2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

06 Hours

UNIT - 3

Customer Satisfaction and Customer Involvement:

Customer Satisfaction : customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies.

Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.

07 Hours

UNIT - 4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Tools and Techniques: Benchmarking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

07 Hours

PART - B

UNIT - 5

Quality Management Tools : Why Why, forced field analysis, nominal group technique, affinity diagram, interrelationship digraph, tree diagram, matrix diagram, prioritization matrices, process decision program chart, activity network diagram.

07 hours

UNIT - 6

Statistical Process Control : Pareto diagram, process flow diagram, cause-and-effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

06 Hours

UNIT - 7

Building and Sustaining Performance Excellence in Organizations : Making the commitment to total quality, organizational culture and total quality, change management, sustaining the quality organization, self-assessment processes, implementing ISO 9000, Bald ridge, and sis sigma, a view toward the future.

07

Hours

UNIT - 8

Design for Six Sigma: Tools for concept development, tools for design development, tools for design optimization, tools for design verification, problems.

06 Hours

TEXT BOOKS:

1. **Total Quality Management:** Dale H. Bester field, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **Total Quality Management for Engineers:** M. Zairi, ISBN: 1855730243, Publisher: Wood head Publishing

REFERENCE BOOKS:

1. **A New American TQM, four revolutions in management,** Shoji Shiba, Alan Graham, David Walden, Productivity press, Oregon, 1990
2. **100 Methods for Total Quality Management:** Gopal K. Kanji and Mike Asher, ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1
3. **Organisational Excellence through TQM,** H. Lal, New age pub, 2008

ELECTIVE-II (GROUP C)
EXPERIMENTAL STRESS ANALYSIS

Sub Code	: 10ME 761	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT-1

Electrical Resistance Strain Gages: Strain sensitivity in metallic alloys, Gage construction, Adhesives and mounting techniques, Gage sensitivity and gage factor, Performance Characteristics, Environmental effects, Strain Gage circuits. Potentiometer, Wheatstone's bridges, Constant current circuits.

06 Hours

UNIT-2

Strain Analysis Methods: Two element, three element rectangular and delta rosettes, Correction for transverse strain effects, Stress gage, Plane shear gage, Stress intensity factor gage.

06 Hours

UNIT-3

Photo-elasticity: Nature of light, Wave theory of light - optical interference , Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinics & Isochromatics, Fringe order determination Fringe multiplication techniques, Calibration photoelastic model materials

08 Hours

UNIT-4

Two Dimensional Photo-elasticity: Separation methods: Shear difference method, Analytical separation methods, Model to prototype scaling, Properties of 2D photo-elastic model materials, Materials for 2D photo-elasticity

06 Hours

PART -B

UNIT-5

Three Dimensional Photo elasticity: Stress freezing method, Scattered light photo-elasticity, Scattered light as an interior analyzer and polarizer, Scattered light polariscope and stress data Analyses.

06 Hours

UNIT-6

Photoelastic (Birefringent) Coatings : Birefringence coating stresses, Effects of coating thickness: Reinforcing effects, Poisson's, Stress separation techniques: Oblique incidence, Strip coatings. **08 Hours**

UNIT-7

Brittle Coatings: Coatings stresses, Crack patterns, Refrigeration techniques, Load relaxation techniques, Crack detection methods, Types of brittle coatings, Calibration of coating. Advantages and brittle coating applications.

06 Hours

UNIT-8

Moire Methods: Moire fringes produced by mechanical interference .Geometrical approach, Displacement field approach to Moire fringe analysis ,Out of plane displacement measurements, Out of plane slope measurements .Applications and advantages

06 Hours

TEXT BOOKS:

1. "Experimental Stress Analysis", Dally and Riley, McGraw Hill.
2. "Experimental Stress Analysis". Sadhu Singh, Khanna publisher.
3. **Experimental stress Analysis**, Srinath L.S tata McGraw Hill.

REFERENCES BOOKS :

1. "Photoelasticity Vol I and Vol II, M.M.Frocht, John Wiley & sons.
2. "Strain Gauge Primer", Perry and Lissner,
3. "Photo Elastic Stress Analysis", Kuske, Albrecht & Robertson John Wiley & Sons.
4. "Motion Measurement and Stress Analysis", Dave and Adams,

OPERATION MANAGEMENT

Sub Code	: 10ME 81	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART – A

UNIT 1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues and development

06 Hours

UNIT 2

Decision Making: The decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.

06 Hours

UNIT 3

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast,

07 Hours

UNIT 4

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

07 Hours

PART – B

UNIT 5

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.

08 hours

UNIT 6

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

06 Hours

UNIT 7

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

07 Hours

UNIT 8

Purchasing and Supply Chain Management (SCM): Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

06 Hours

TEXT BOOK:

1. **Production and Operations Management**, William J Stevenson, 9th Ed., Tata McGraw Hill.
2. **Operations Management-Theory and Practice**, B Mahadevan, Pearson Education, 2007.

REFERENCES:

1. **Production and Operations Management**, Norman Gaither & Greg Frazier,
2. **Operations Management for Competitive Advantage**, R.B.Chase, N.J.Aquilino, F. Roberts Jacob; McGraw Hill Companies Inc., Ninth Edition.
3. **Production & Operations Management**, Everett E.Adams, Ronald J.Ebert, Prentice Hall of India Publications, Fourth Edition.

4. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books

CONTROL ENGINEERING

Sub Code	: 10ME 82	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers- Proportional, Integral Proportional Integral, Proportional Integral Differential controllers.

07 Hrs

UNIT- 2

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems, pneumatic system, Analogous systems: Force voltage, Force current.

06 Hrs

UNIT - 3

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

07 Hrs

UNIT- 4

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

06 Hrs

PART -B

UNIT - 5

Frequency Response Analysis: Polar plots, Nyquist stability criterion, Stability analysis, Relative stability concepts, Gain margin and phase margin, M&N circles.

06 Hrs

UNIT - 6

Frequency Response Analysis Using Bode Plots: Bode attenuation diagrams, Stability analysis using Bode plots, Simplified Bode Diagrams.

07 Hrs

UNIT - 7

Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots.

06 Hrs

UNIT 8

System Compensation and State Variable Characteristics of Linear Systems: Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

07 Hrs

TEXT BOOKS :

1. **Modern Control Engineering,** Katsuhiko Ogatta, Pearson Education,2004.
2. **Control Systems Principles and Design,** M.Gopal, 3rd Ed., TMH,2000.

REFERENCE BOOKS :

1. **Modern Control Systems,** Richard.C.Dorf and Robert.H.Bishop, Addison Wesley,1999
2. **System dynamics & control,** Eronini-Umez, Thomson Asia pte Ltd. singapore, 2002.
3. **Feedback Control System,** Schaum"s series. 2001.

ELECTIVE-II (GROUP - D)

TRIBOLOGY

Sub Code	: 10ME 831	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Introduction To Tribology: Properties of oils and equation of flow: Viscosity, Newton"s Law of viscosity, Hagen-Poiseuille Law, Flow between

parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hours**

UNIT - 2

Hydrodynamic Lubrication: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, mechanism of pressure development in an oil film, Reynold's investigation and Reynold's equation in 2D. **06 Hours**

UNIT - 3

Idealized Journal Bearing: introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's numbers and significance of it; Partial bearings, end leakages in journal bearing, numerical problems. **07 Hours**

UNIT - 4

Slider / Pad Bearing With A Fixed And Pivoted Shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, numerical examples. **07 Hours**

PART - B

UNIT - 5

Oil Flow And Thermal Equilibrium Of Journal Bearing: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. **06 Hours**

UNIT - 6

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing. **06 Hours**

UNIT - 7

Bearing Materials: Commonly used bearings materials, properties of typical bearing materials. Advantages and disadvantages of bearing materials. **07 Hours**

UNIT - 8

Behavior Of Tribological Components: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. Tribological measures, Material selection, improved design, surface engineering **07 Hours**

TEXT BOOKS:

1. **Fundamentals of Tribology** , Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006

2. **Introduction to Tribology Bearings**, Mujumdar B. C., S. Chand company pvt. Ltd 2008.

REFERENC BOOKS:

1. **Theory and Practice of Lubrication for Engineers**, Fuller, D., New York company 1998
2. **Principles and Applications of Tribology**, Moore, Pergamon press 1998
3. **Tribology in Industries**, Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings – Theoretical Principles and Design**, Redzimoskay E I., Oxford press company 2000

POWER PLANT ENGINEERING

Sub Code	: 10ME 833	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT 1

Steam Power Plant:

Different types of fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverised fuel, Equipment for preparation and burning of pulverised coal, unit system and bin system. Pulverised fuel furnaces, cyclone furnace.

7 Hrs

UNIT 2

Coal, Ash Handling and Different Types of Boilers :

Coal and Ash handling, Generation of steam using forced circulation, high and supercritical pressures, A brief account of L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators.

6 Hrs

UNIT 3

Chimneys, Accessories for the Steam Generator Cooling Towers And Ponds:

Natural, forced, induced and balanced draft, Calculations involving height of chimney to produce a given draft. Accessories For The Steam Generator such as super-heaters, desuperheater, control of super heaters, Economisers, Air Pre-heaters Study of different types of cooling towers and ponds.

6 Hrs

UNIT 4

Diesel Engine and Gas Turbine Power Plant:

Method of starting diesel engines, Cooling and lubrication system for the diesel engine. Filters, centrifuges, Oil heaters, Intake and exhaust system, Layout of a diesel power plant. Advantages and disadvantages of the gas turbine plant, Open and closed cycle turbine plants with the accessories.

7Hrs

PART – B

UNIT 5

Hydro-Electric Plants: Storage and pondage, flow duration and mass curves, hydrographs, Low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, gates and valves, power house,

general layout. A brief description of some of the important Hydel Installations in India.

7Hrs

UNIT 6

Nuclear Power Plant: Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors. Multiplication and thermal utilization factors. Elements of the Nuclear reactor, Moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types - Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Radio active waste disposal.

7 Hrs

UNIT 7

Choice of site for power station, load estimation, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, Effect of variable load on power plant, selection of the number and size of units.

6 Hrs

UNIT 8

Economic Analysis of power plant: Cost of energy production, selection of plant and generating equipment, performance and operating characteristics of power plants, tariffs for electrical energy.

6 Hrs

TEXT BOOKS:

1. **Power Plant Engineering**, P.K Nag, 3rd Ed. Tata McGraw Hill 2nd ed 2001,
2. **Power Plant Engineering**. Morse F.T., Van Nstrand.1998

REFERENCE BOOKS:

1. **Water Power Engg.**, Edition 3, Barrows, TMH, New Delhi. 1998
2. **Plant Engg. Hand Book**, Stanier, McGraw Hill. 1998
3. **Hydraulic Machines**, Jagadish Lal, Metropolitan Co 1996.
4. **Principles of Energy Conversion**, A.W. Culp Jr., McGraw Hill. 1996
5. **Power Plant Technology**, M.M. EL-Wakil, McGraw Hill, International. 1994
6. **Power Station Engg. Economics**, Skrotizke and V opat. 1994
7. **Power Plant Engineering**, Domakundawar, Dhanpath Rai sons.2003

ELECTIVE-II (GROUP - E)

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 844	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Engine Components And Cooling & Lubrication Systems: Spark Ignition (SI) & Compression Ignition (CI) engines, cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I.Engine and C.I.Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

07 Hours

UNIT - 2

Fuels, Fuel Supply Systems For Si And Ci Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps and injectors.

07 Hours

UNIT - 3

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types pf superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

06 Hours

UNIT - 4

Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

06 Hours

PART - B

UNIT - 5

Power Trains: General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multi-plate and centrifugal clutches.

Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters, Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

08 Hours

UNIT - 6

Drive To Wheels: Propeller shaft and universal joints, Hotchkiss and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer, numerical problems, types of chassis frames.

06 Hours

UNIT - 7

Suspension, Springs And Brakes: Requirements, Torsion bar suspension systems, leaf spring, coil spring, independent suspension for front wheel and rear wheel. Air suspension system.

Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, drum brakes, Antilock –Braking systems, purpose and operation of antilock-braking system, ABS Hydraulic Unit, Rear-wheel antilock & Numerical Problems

06 Hours

UNIT - 8

Automotive Emission Control Systems: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

6 Hours

TEXT BOOKS:

1. **Automotive mechanics**, William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007
2. **Automotive Mechanics**, S. Srinivasan, 2nd Ed., Tata McGraw Hill 2003.

REFERENCE BOOKS:

1. **Automotive mechanics: Principles and Practices**, Joseph Heitner, D Van Nostrand Company, Inc
2. **Fundamentals of Automobile Engineering**, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
3. **Automobile Engineering**, R. B. Gupta, Satya Prakashan, 4th edn. 1984.
4. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

DATABASE MANAGEMENT SYSTEM

AUTOMOTIVE ENGINEERING

Sub Code	: 10ME 845	IA Marks	25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

PART - A

UNIT - 1

Database And Database Users: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

06 Hours

UNIT - 2

Database Systems Concepts And Architecture: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

06 Hours

UNIT - 3

Data Modeling: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

08 Hours

UNIT - 4

Record Storage And Primary File Organizations: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

06 Hours

PART - B

UNIT - 5

Relational Data Model And Relational Algebra: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations, queries in relational algebra.

07 Hours

UNIT - 6

Structural Query Language (Sql): Data definition etc., in SQL2. Basic and complex queries in SQL, Inset, Delete; Update statements, and views in SQKL, embedded SQL.

07 Hours

UNIT - 7

Database Design: Design guidelines for relational schemas, functional dependencies, normalization 1st, 2nd, 3rd, 4th and 5th; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

07 Hours

UNIT - 8

System Implementation: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

05 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems**, Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System**, Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Management and Design**, Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems**, Designing and Building business applications by Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM**, Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

SEMESTER I

MANAGEMENT & ORGANIZATIONAL BEHAVIOUR

Subject Code	: 16MBA11	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To make students understand fundamental concepts and principles of management, including the basic roles, skills, and functions of management
- To make students knowledgeable of historical development, theoretical aspects and practice applications of managerial process
- To understand the basic concepts and theories underlying individual behavior besides developing better insights into one's own self
- To make students aware of Individual behavior in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves

Course Outcomes:

At the end of the course students are able to:

- Comprehend & correlate all the management activities which are happening around them with fundamental concepts and principles of management.
- Get an overview of management, theory of management and practical applications of the same.
- Effectively use their individual skill to work in groups to achieve organizational goals and ability to lead groups/teams.

- Demonstrate their acumen in applying managerial and behavioral concept in real world/situation.

Part A - Principles of Management

Unit 1: (8 Hours)

Introduction: Management: Introduction, Definition of management, Nature, Purpose and Functions, Levels and types of managers, managerial roles, skills for managers, evolution of management thought, Fayol's fourteen principles of management, Recent trends in management.

Unit 2: (12 Hours)

Planning and Organizing:

Planning: Nature of Planning, Planning Process, Objectives, MBO, Strategies, level of strategies, policies, methods and programs, Planning Premises, Decision-making, Process of decision-making, Types of decisions, Techniques in decision-making.

Organizing: Organization structure, Formal and informal organizations, Principles of organizations-chain of command, span of control, delegation, decentralization, and empowerment. Functional, divisional, geographical, customer based and matrix organizations, team based structures, virtual organizations, boundary less organizations.

Unit 3: (5 Hours)

Controlling: Controlling, importance of controlling, controlling process, types of control, factors influencing control effectiveness.

RECOMMENDED BOOKS

- Essentials of Management-Koontz, 8/e, McGraw Hill
- Management: Text and Cases-VSP Rao, Excel Books
- MGMT, An Innovative approach to teaching and learning Principles of Management, Chuck Williams, Cengage Publications, 2010

- Principles and practices of Management, Kiran Nerkar, Vilas Chopde, Dreamtech Press, 2011
- Management Theory & practice – Chandan J. S, Vikas Publishing House.
- Management Theory & Practice Text & Cases – Subba Rao P & Hima Bindu, Himalaya Publication.

REFERENCE BOOKS:

- Masters of Management Thought – Mahanand Charati & M M Munshi, Sapna Book House, Bangalore, 2015.

Part B - Organizational Behaviour

Unit 4: (6 hours)

Introduction: Organizational Behaviour: Introduction, definition, historical development, fundamental principles of OB, contributing disciplines, challenges and opportunities.

Unit 5: (15 Hours)

Foundations of Individual Behaviour: Individual behaviour: Foundations of individual behaviour. Ability: Intellectual abilities, Physical ability, the role of disabilities.

Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB.

Attitude: Formation, components of attitudes, relation between attitude and behaviour.

Perception: Process of perception, factors influencing perception, link between perception and individual decision-making.

Unit 6: (10 Hours)

Motivation: Meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories.

Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories.

Note: Related case studies to be discussed.

Practical Components:

- Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied in Unit 2 and justifying why such structures are chosen by those organizations.
- Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities and behaviours with respects to the trait, behavioural and contingency theories studied.
- Identifying any five job profiles and listing the various types, abilities required for those jobs and also the personality traits/attributes required for the jobs identified.

Note: Faculty can either identify the organizations/ leaders/jobs or students can be allowed to choose the same.

RECOMMENDED BOOKS:

- Organizational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, 14th Edition, Pearson, 2012.
- Introduction to Organisational Behaviour – Michael Butler, Jaico Publishing House,
- Organization Behaviour – Ashwathappa, Himalaya Publication House
- ORGB - Nelson, Quick, Khanelwal, 2/e, Cengage Learning, 2012.
- Organizational Behaviour - Anada Das Gupta, Biztantra, 2011.
- Organizational Behaviour: A modern approach - Arun Kumar and Meenakshi, Vikas Publishing House, 2011.
- Organizational Behaviour – Rao V. S. P, Excel BOOKS, 2009.

REFERENCE BOOKS:

- Organizational Behaviour - Fred Luthans, 12/e, McGraw Hill International, 2011.
- Management and Organizational Behaviour - Laurie J Mullins, Pearson education

- Fundamentals of Organizational Behaviour - Slocum/Hillriegel, Cengage Learning
- Organizational Behaviour, Aquinas P. G, Excel Books.

ECONOMICS FOR MANAGERS

Subject Code	: 16MBA12	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

COURSE OBJECTIVES

- To introduce the fundamentals, tools and theories of managerial economics
- To orient on micro economic techniques as a decision making process
- To understand various industrial policies essential for business managers
- To understand the vital characteristics of different market structures

COURSE OUTCOMES

At the end of the course students are able to:

- Equipped with the skill to apply the theory of demand, theory of production and cost in decision making
- Differentiate between various markets structure, functioning and pricing decisions.
- Acquire the knowledge of Indian Industrial Policies, its impact on industrial development so as to develop proper strategy in day to day management.

Unit 1: (12 hours)

Managerial Economics: Meaning, Nature, Scope. & Significance, Uses of Managerial Economics, Objectives and alternative hypothesis of the firm – Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand- Price, Income, Cross and Advertising Elasticity, Uses of Elasticity of Demand for Decision Making, - Demand Forecasting: Meaning and Significance.(problems on Elasticity of Demand only).

Unit 2: (10 hours)

Production Analysis: Concept, Production Function- Total, Average, & Marginal Product –Law of Variable Proportions & ISO-Quants & ISO Costs - Least cost factor combination- Returns to Scale- Economies and Diseconomies of Scale - Technological progress and production function

Unit 3: (8 hours)

Cost and Revenue Profit Functions: Cost Concepts, Fixed and variable costs- Total Cost, Average Cost, Marginal Cost, Opportunity Cost. - Short-run and Long-run Cost Curves

Profits: Determinants of Short-Term & Long Term Profits, Measurement of Profit.

Break Even Analysis- Meaning, Assumptions, Determination of BEA, Limitations and Uses of BEA in Managerial Economics (Problems on BEP only)

Unit 4: (8 hours)

Market Structure: Perfect Competition: Features, Determination of Price under Perfect Competition - Monopoly: Features, Pricing under Monopoly, Price Discrimination - Oligopoly: Features, Kinked Demand Curve, Cartel, Price Leadership - Monopolistic Competition: Features, Pricing under Monopolistic Competition, Product Differentiation Pricing - Descriptive Pricing- Price Skimming, Price Penetration.

Unit 5: (8 hours)

Indian Economic Environment: Overview of Indian Economy, Recent changes in Indian Economy.

Measurement of National Income: Basic Concepts, Components of GDP- Measuring GDP and GNP, Difficulties in measuring National Income, Growth Rate.

Business Cycle – Features, Phases, Economic Indicators, Inflation: Types, causes, Measurement, Kinds of Price Indices, Primary, Secondary and Tertiary Sectors and their contribution to the Economy, SWOT Analysis of Indian Economy.

Unit 6: (10 hours)

Industrial Policies and Structure: A critical look at Industrial Policies of India, New Industrial Policy 1991; Disinvestment in PSUs - Private Sector- Growth, Problems and Prospects, SMEs – Significance in Indian economy-problems and prospects

Economic Policies: Fiscal Policy: Objectives, Instruments, Union Budget,

Monetary Policy: Objectives, tools for Credit Control.

Globalization: Meaning and Implications, Phases, Impact of Globalization on Indian Economy.

Foreign Trade: Trends in India's Foreign Trade, Impact of WTO on India's Foreign Trade.

Note 1: Related case studies to be discussed.

Note 2: 75 percent theory and 25 percent problems from Unit 1 & 3

Practical Components:

- Assessment of Impact of advertisement or sales promotion on the demand of a product (Preferably FMCG goods)
- Study of demand elasticity for a product when there is a price increase or price decrease.
- Demand forecasting – Mini project may be given to students to assess the demand for a product or a service using any method.
- Preparing a project proposal for a new business venture to understand the BEP using real time data.
- An in-depth study of economic indicators on the growth rate

- Analysis of recent budget, fiscal discipline and disinvestment proposals of the GOI
- A study on the effect of monetary policy on banking and NBFCs
- A futuristic study of leading Indian industries and observations of CAG on major issues.

RECOMMENDED BOOKS:

- Managerial Economics, D.N Dwivedi, 6th ed., Vikas Publication.
- Managerial Economics- Theory and Applications, Dr. D.M Mithani, Himalaya Publications.
- Managerial Economics, H. L Ahuja, S. Chand, 2011
- Indian Economy, K P M Sundharam and Dutt, 64th Edition, S Chand Publication.
- Indian Economy, Misra and Puri, Himalaya Publications
- Business Economics, ML Jhingan and Upadhyaya, Vrinda Publications
- Business Environment Text and Cases by Justin Paul, 3rd Edition, McGraw-Hill Companies.

REFERENCE BOOKS:

- Managerial Economics- Principles and worldwide applications, Dominick Salvatore, 6e, Oxford Publication, 2010
- Managerial Economics, Jaswinder Singh, Dreamtech publications, 2013
- Managerial Economics, Yogesh Maheswari, PHI, 2013
- Modern Economic Theory, KK Dewett and MH Navalur, S Chand Publication, 2013
- Managerial Economics: Case study solutions- Kaushal H, 1/e., Macmillan, 2011

ACCOUNTING FOR MANAGERS

Subject Code	: 16MBA13	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To explain fundamental accounting concepts and conventions.
- To explain and use the accounting equation.
- To prepare basic journal entries for business transactions and present the data in an accurate manner
- To present financial statements in vertical and horizontal format.
- To analyze a company's financial statements using various ratios for decision making.
- To understand emerging issues in accounting and taxation.

Course Outcomes:

At the end of the course students are able to:

- Acquire the knowledge about the concepts and fundamental principles of accounting.
- Demonstrate theoretical knowledge and its application in real time accounting.
- Capable of preparing financial statement of sole trading concerns and companies.
- Independently undertake financial statement analysis and take decisions.
- Comprehend emerging trends in accounting and taxation.

Unit 1: (6 Hours)

Introduction to Accounting: Need and Types of Accounting, Users of Accounting, concepts and conventions of Accounting, Accounting Equation (problems on accounting equation).

Unit 2: (10 Hours)

Preparation of books of Accounts: Journals, three column cash book, ledgers and trial balance. Depreciation- Straight line and Written down Value Methods.

Unit 3: (14 Hours)

Preparation of Financial Statements: Preparation of final accounts of sole traders. Preparation of final accounts of companies, vertical form of financial statements. (Basic problems Final Accounts)

Unit 4: (12 Hours)

Analysis of Financial Statements: Ratio Analysis, Preparation of financial statements using ratios, Preparation of Cash flow Statement (only indirect method).

Unit 5: (8 Hours)

Emerging issues in Accounting: Human Resource Accounting, Forensic Accounting, Sustainability Reporting -**Accounting Standards and IFRS:** Nature and significance

Unit 6: (6 Hours)

Fundamentals of Taxation: Heads of Income, Deductions u/s 80C, Income Tax Rates and Returns for Individuals only (only theory)

Practical Components:

- Collecting Annual reports of the companies and analyzing the financial statements using different techniques and presenting the same in the class.
- Analyzing the companies' cash flow statements and presenting the same in the class.

- Exposing the students to usage of accounting software's (Preferably Tally)
- Filling up of ITR forms
- Identify the sustainability report of a company and study the contents.

Note 1: Related case studies to be discussed.

Note 2: 25 percent theory and 75 percent problems

RECOMMENDED BOOKS:

- Financial Accounting: A Managerial Perspective, Narayanaswamy R, 5/e , PHI, 2014
- A Text book of Accounting For Management, Maheswari S. N, Maheswari Sharad K. Maheswari , 2/e, Vikas Publishing house (P) Ltd.
- Financial Accounting, Tulsian P. C, 1/e, Pearson Education.
- Accounting for managers, Madegowda J, Himalaya Publishing House.
- Advanced Accountancy, Gupta R. L & Radhaswamy M, Sultan Chand Publications.
- Financial Accounting, Jain S. P and Narang K L, Kalyani Publishers.
- Business Taxation, Akhileshwar Pathak and Savan Godiawala, 2/e, McGraw Hill Education (India) Pvt. Ltd, 2013.

REFERENCE BOOKS:

- Financial Accounting for Management: An Analytical Perspective, Ambrish Gupta, 4/e, Pearson Education.
- Introduction to Financial Statement Analysis, Ashish K Bhattacharya, Elsevier India.
- Financial Accounting – Raman B. S, Vol I & Vol II, 1/e, United Publishers, 2011.
- Financial Accounting (IFRS update), Gary A. Porter & Curtis L. Norton, 6/e, Cengage Learning.

- Accounting For Management, Arora M. N, Himalaya Publishing House.
- Essentials of Financial Accounting (Based on IFRS), Bhattacharya, 3/e, Prentice Hall India.
- Comdex (Computer and Financial Accounting with Tally 9.0 Course Kit), Dream Tech.
- Comdex – Tally 9, Namrata Agrawal - DreamTech.
- IFRS: A Practical approach, Jasmine Kaur, McGraw Hill.

QUANTITATIVE METHODS

Subject Code	: 16MBA14	IA Marks	: 20
No. of Lecture Hours / Week:	03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To introduce statistics as a tool for business decision making.
- To provide an analytical foundation for dealing business situations.
- To learn how to take decision under various situations.
- To familiarize the use of linear programming and project management evaluation techniques.
- To orient the students with statistical tools.

Course Outcomes:

At the end of the course students are able to:

- Understand and applying descriptive statistical tools in business situations.
- Exhibit the skills in developing and applying probability distribution concepts in business and real time scenario.
- Develop the skills of decision making using Decision Theory.

- Develop mathematical models using Linear Programming technique.
- Illustrate the use of network techniques for successful project implementation

Unit 1 **(10 Hours)**

Descriptive Statistics: Measures of Central Tendency- mean, median, mode, Measures of Dispersion- Standard deviation, variance, Co-efficient of Variance.

Unit 2 **(8 Hours)**

Correlation and Regression: Scatter Diagram, Karl Pearson correlation, Spearman's Rank correlation (one way table only), simple and multiple regression (problems on simple regression only)

Unit 3 **(8 Hours)**

Probability Distribution: Concept and definition - Rules of probability – Random variables –Concept of probability distribution – Theoretical probability distributions: Binomial, Poisson, Normal and Exponential – Baye's theorem (No derivation) (Problems only on Binomial, Poisson and Normal).

Unit 4 **(10 Hours)**

Decision Theory: Introduction – Steps of decision making process-types of decision making environments-decision making under uncertainty- Decision making under Risk- Decision tree analysis (only Theory)

Unit 5 **(10 Hours)**

Linear Programming: structure, advantages, disadvantages, formulation of LPP, solution using Graphical method.

Transportation problem: basic feasible solution using NWCM, LCM, and VAM unbalanced, restricted and maximization problems.

Unit 6

(10 Hours)

Project Management: Introduction – Basic difference between PERT & CPM – Network components and precedence relationships – Critical path analysis – Project scheduling – Project time-cost trade off – Resource allocation, basic concept of project crashing.

Theory 25 percent and Problems percent

Practical Component:(Student-Centered Learning)

- Students are expected to have basic Excel knowledge-hands on experience.
- Students should be able to relate the concepts to real time business situations.
- Student should demonstrate the application of statistical tools.

RECOMMENDED BOOKS:

- Statistical Methods, S. P Gupta, Sulthan Chand & sons, New Edition,
- Quantitative Techniques in Management, N D Vohra, 4th Edition, Tata McGraw Hill, 2010.
- Fundamentals of Statistics, S.C Gupta, 6th edition, Himalaya Publishing House, 2007

REFERENCE BOOKS:

- Operations Research – Theory & Applications, J K Sharma, 5th edition, Macmillan publishers, 2013.
- Quantitative Methods for Business, Anderson, Sweeney and Williams, Thomson, 2005.
- Analyzing Multivariate Data, James Lattin, Douglas Carroll and Paul Green, Thomson Learning, 2003.

MARKETING MANAGEMENT

Subject Code	: 16MBA15	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide an insight to basic concepts of marketing management.
- To understand various marketing models for solving marketing problems.
- To understand fundamental premise underlying market driven strategies.

Course Outcome:

At the end of the course students are able to:

- Acquire knowledge regarding basic concepts and functions of Marketing Management.
- Apply various marketing concepts to solve day-to-day corporate problems.
- Learn various strategies which enable decision making process.
- Study ever-changing environment and use of appropriate models and techniques of Marketing.
- Synthesize ideas into a viable marketing plan.

Unit 1: (10 hours)

Introduction to Marketing: Introduction, Definitions of market and marketing, The Exchange Process, Elements of Marketing Concept, Functions of Marketing, Old Concept or Product- oriented Concept, New or Modern or Customer- oriented Concept, Marketing Environment, Techniques used in environment analysis, Characteristics (Micro and Macro), Marketing to the 21st century customer

Unit 2: (8 hours)
Consumer Behaviour Analysis: Meaning and Characteristics, Importance, Factors Influencing Consumer Behaviour, Consumer Purchase Decision Process, Buying Roles, Buying Motives, Buyer Behaviour Models

Unit 3: (10 hours)
Market Segmentation, Targeting & Positioning: Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies.
Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Branding - Concept of Branding, Types, Brand Equity, Branding strategies.

Unit 4: (8 hours)
Managing the Product: Concept, product hierarchy, product line, product mix, product mix strategies, Product life cycle and its strategies, New Product Development, packing as a marketing tool, Role of labelling in packing.

Unit-5 (10 hours)
Pricing decisions: Significance of pricing, factor influencing pricing (Internal factor and External factor), objectives, Pricing Strategies-Value based, Cost based, Market based, Competitor based, Pricing Procedure.
Marketing Channels: Meaning, Purpose, Factors Affecting Channel Choice, Channel Design, Channel Management Decision, Channel Conflict, Designing a physical Distribution System, Network Marketing,

Unit 6: (10 hours)
Marketing Planning: Meaning, Concepts, Steps involved in Marketing planning, Marketing Audit- Meaning, Feature, Various components of Marketing Audit Marketing Strategy-Analysis of Industry and Competition, Strategic Planning Process,

Case Studies in Indian Context

Practical Components:

- Analyze Product Life Cycle of few Products like-Electronic goods, Computers etc.
- Study Packaging strategies used by FMCG companies
- Understand Marketing strategies, plans used by automobile, cosmetic, FMCG companies etc.

RECOMMENDED BOOKS

- Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 13/e, Pearson Education, 2012
- Marketing Management, Ramaswamy V. S. & Namakumari S, 4/e, TMH, 2014
- Fundamentals of Marketing Management, Etzel M.J BJ Walker & William J. Stanton, 14/e, TMH, 2012
- Marketing Management: An Applied Approach, Noel Capon & Siddharth Shekhar Singh, Wiley, 2014

REFERENCE BOOKS

- Marketing Management, Arun Kumar & Meenakshi N, 2/e, Vikas, 2012
- Applied Case Studies in Marketing – Shajahan S, Primus BOOKS, 2011.
- Marketing Management – Karunakaran, HPH.
- Marketing in India: Text and Cases- Neelamegham S, 4/e, Vikas.
- Marketing- Lamb, Hair, Mc Danniel, 7/e, Cengage Learning 2012.
- Marketing: Planning, Implementation, and Control -William M. Pride, Ferrell O. C, Cengage Learning, 2010.
- Marketing Management, Tapan Panda, 2/e, Excel Publication

MANAGERIAL COMMUNICATION

Subject Code	: 16MBA16	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objective:

To enhance students communication skills through verbal, non-verbal, correspondence, presentations, interviews and negotiation.

Course Outcomes:

At the end of the course students are able to:

- Describe and develop written and oral communication.
- Independently prepare business letters and reports.
- Exhibit, develop and apply negotiation strategies.
- Gain exposure to media management and demonstrate the skill in analyzing business situation.

Unit 1: (10 Hours)

Introduction: Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication – Importance of communication in management – Communication structure in organization – Communication in conflict resolution - Communication in crisis. Communication and negotiation - Communication in a cross-cultural setting

Unit 2: (8 Hours)

Oral Communication: Meaning – Principles of successful oral communication – Barriers to communication – Conversation control – Reflection and Empathy: two sides of effective oral communication.

Modes of Oral Communication - Listening as a Communication Skill,
Non-verbal communication

Unit 3: (8 Hours)

Written Communication: Purpose of writing – Clarity in writing – Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features – Coherence – Electronic writing process.

Unit 4: (12 Hours)

Business Letters and Reports: Introduction to business letters – Types of Business Letters - Writing routine and persuasive letters – Positive and Negative messages Writing Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing Proposals: Structure & preparation - Writing memos

Media Management: The press release – Press conference – Media interviews

Group Communication: Meetings – Planning meetings – objectives – participants – timing – venue of meetings.

Meeting Documentation: Notice, Agenda, and Resolution & Minutes

Unit 5: (10 Hours)

Presentation skills: What is a presentation – Elements of presentation – Designing & Delivering Business Presentations – Advanced Visual Support for managers.

Case Methods of learning: Understanding the case method of learning.

Negotiation skills: What is negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies.

Unit 6: (8 Hours)

Employment communication: Introduction – Composing Application Messages - Writing CVs – Group discussions – Interview skills

Impact of Technological Advancement on Business Communication

– Technology-enabled Communication-**Communication networks**–
Intranet–Internet–E-mails–SMS– teleconferencing – videoconferencing

Practical Components:

- Demonstrate the effect of noise as a barrier to communication
- Make students enact and analyze the non-verbal cues
- Give exercises for clarity and conciseness in written communication.
- Demonstrating using Communication Equipments like Fax, Telex, Intercoms, etc,
- Demonstrating Video conferencing & teleconferencing in the class.
- Conduct a mock meeting of students in the class identifying an issue of their concern. The students should prepare notice, agenda and minutes of the meeting.
- Each student to give presentation of 5 minutes (this can be spread throughout the semester)and to be evaluated by the faculty

RECOMMENDED BOOKS:

- Business Communication : Concepts, Cases And Applications – Chaturvedi P. D, & Mukesh Chaturvedi ,2/e, Pearson Education,2011
- Business Communication: Process and Product – Mary Ellen Guffey, 3/e, Cengage Learning, 2002.
- Business Communication – Renuka Murthy T P and YathishChandra M S, HPH.
- Business Communication – Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010
- Advanced Business Communication – Penrose, Rasberry, Myers, 5/e, Cengage Learning, 2004.
- BCOM – Lehman, DuFrene, Sinha, Cengage Learning, 2/e, 2012
- Business Communication – Madhukar R. K, 2/e, Vikas Publishing House.

REFERENCE BOOKS:

- Effective Technical Communication - Ashraf Rizvi M, TMH, 2005.

- Business Communication - Sehgal M. K & Khetrapal V, Excel Books.
- Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.
- Basic Business Communication – Raj Kumar, Excel Books, 2010.

SEMESTER II
HUMAN RESOURCE MANAGEMENT

Subject Code	: 16MBA21	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the HRM concepts and theory
- To obtain an overview of various HRM functions and practices
- To gain an insight into the various statutory provisions

Course outcome:

At the end of the course students will be able to:

- Synthesize information regarding the effectiveness of recruiting methods & selection procedures
- Identify the various training methods and design a training program
- Design a job description and job specification for various levels of employees.
- List out the regulations governing employee benefit practices.

Unit 1:

(8 hours)

Human Resource Management:

Introduction, meaning, nature, scope of HRM - Importance and Evolution of the concept of HRM - Major functions of HRM - Principles of HRM

Unit 2:

(10 hours)

Job Analysis: Meaning, process of Job Analysis, methods of collecting job analysis data, Job Description and Job Specification, Role Analysis.

Human Resource Planning: Objectives, Importance and process of Human Resource Planning, Effective HRP.

Unit 3:

(10 hours)

Recruitment: Definition, Constraints and Challenges, Sources and Methods of Recruitment, New Approaches to recruitment.

Selection: Definition and Process of Selection.

Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation.

Unit 4:

(8 hours)

Training and development: Training v/s development, Training v/s Education, Systematic Approach to Training, Training Methods.

Unit 5:

(10 hours)

Performance Appraisal: Concept of Performance Appraisal, the Performance Appraisal Process, Methods of Performance Appraisal

Compensation: Objectives of Compensation Planning, Job Evaluation, Compensation Pay Structure in India.

Unit 6:

(10 hours)

Employee Welfare: Introduction, Types of Welfare Facilities and Statutory Provisions.

Employee Grievances: Employee Grievance procedure, Grievances Management in Indian Industry.

Discipline: Meaning, approaches to discipline, essential of a good disciplinary system, managing difficult employees.

Practical Components:

- Give a case and ask the students to prepare the recruitment advertisement for a newspaper.
- Expose students to standard selection tests followed in various sectors.
- Exploring training and development practices.
- Exploring performance appraisal practices in various sectors.
- Exploring employee separation practices.
- Give a job analysis case and ask the students to prepare job description and job specification.
- Ask the students to prepare an appointment letter for the post of office manager of a company known to you.

RECOMMENDED BOOKS:

- Human Resources Management: A South Asian Perspective, Denski/Griffin/Sarkar-Cengage Learning, 2012.
- Human Resource Management – Rao V. S. P, Excel BOOKS, 2010
- Human Resource Management - Lawrence S. Kleeman, Biztantra , 2012.
- Human Resource Management – Dr. T.P RenukaMurthy HPH

REFERENCE BOOKS:

- Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.
- Human Resource Management in practice - Srinivas R. Kandula, PHI, 2009
- Managing Human Resources - Luis R Gomez-Mejia, David B. Balkin, Robert L. Cardy, 6/e, PHI, 2010.
- Human Resource Management & Industrial relations, P.Subba Rao, Himalaya Publishing House, Mumbai.
- Human Resource Management – Aswathappa K HPH

FINANCIAL MANAGEMENT

Subject Code	: 16MBA22	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To familiarize the students with basic concepts of financial management.
- To understand time value of money and cost of capital.
- To analyze capital structure, capital budgeting and dividend decision.
- To understand the short term and long term financing and working capital management.

Course Outcome:

At the end of the course students will be able to:

- Understand the basic financial concepts
- Apply time value of money
- Evaluate the investment decisions
- Analyze the capital structure and dividend decisions.
- Estimate working capital requirements.

Unit 1:

(8 Hours)

Financial management – Introduction to financial management, objectives of financial management – profit maximization and wealth maximization. Changing role of finance managers. Interface of Financial Management with other functional areas.

Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only)

Emerging Issues: Risk management, Behavioral finance and Financial engineering.

Unit 2:

(10 Hours)

Time value of money – Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization.

Unit 3:

(10 Hours)

Cost of Capital Cost of capital – basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) and Marginal cost of capital.

Unit 4:

(12 Hours)

Investment decisions – Capital budgeting process, Investment evaluation techniques – Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return.

Unit 5:

(8Hours)

Working capital management – factors influencing working capital requirements - Current asset policy and current asset finance policy- Determination of operating cycle and cash cycle - Estimation of working capital requirements of a firm (Does not include Cash, Inventory & Receivables Management)

Unit 6:

(8 Hours)

Capital structure and dividend decisions – Planning the capital structure. (No capital structure theories to be covered) Leverages – Determination of operating leverage, financial leverage and total leverage. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, Stable Payout (No dividend theories to be covered)

Practical Components:

- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.
- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Students can choose the companies that have gone for stock split and Bonus issue in the last few years and study the impact of the same on the stock price.

RECOMMENDED BOOKS:

- Financial Management -Prasanna Chandra, 8/e, TMH, 2011.
- Financial Management,Shashi K Gupta and R K Sharma, 8th Revised Edition, Kalyani Publishers, -2014
- Financial Management,Khan M. Y.& Jain P. K, 6/e, TMH, 2011.
- Financial Management,Rajiv Srivastava and Anil Misra, Second edition, Oxford University Press,2011
- Financial Management ,I M Pandey, 10th Edition, Vikas Publishing House -2014
- Financial Management & Policy-Vanhorne, James C., 12/e, Pearson, 2002
- Financial Management, PralhadRathod, Babitha&S.HarishBabu, Himalaya Publishing House, 2015

REFERENCE BOOKS:

- Financial Management,V K Bhalla ,1st Edition- S.Chand 2014,
- Fundamentals of Financial Management,Brigham & Houston, 10/e, Cengage Learning.
- Corporate Finance,Damodaran , 2/e, Wiley India (P) Ltd., 2004
- Financial Management,Paresh P., Shah 2/e, Biztantra.
- Fundamentals of Financial Management,Sheeba Kapil ,Pearson,2013
- Financial Management, Sumit Gulati & Y P Singh,McGraw Hill, New Delhi - 2013

RESEARCH METHODS

Subject Code	: 16MBA23	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the basic components of research design
- To Gain an insight into the applications of research methods
- To equip students with various research analytical tools used in business research

Course outcome:

At the end of the course students are able to:

- Understand various research approaches, techniques and strategies in the appropriate in business.
- Apply a range of quantitative / qualitative research techniques to business and day to day management problems
- Demonstrate knowledge and understanding of data analysis, interpretation and report writing
- Develop necessary critical thinking skills in order to evaluate different research approaches in Business.

Unit 1:

(8 hours)

Business Research – Meaning, types, process of research- management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study.

Unit 2:

(10 hours)

Business Research Design: Meaning and significance - **Types:** Exploratory and Conclusive Research Design.

Exploratory Research: Meaning, purpose, methods- Literature search, experience survey, focus groups and comprehensive case methods.

Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

Unit 3:

(8 hours)

Sampling: Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling –

convenience sampling- judgemental sampling, snowball sampling- quota sampling - Errors in sampling.

Unit 4: (12 hours)

Data Collection: Primary and Secondary data

Primary data collection methods - Observations, survey, Interview and Questionnaire, Qualitative Techniques of data collection, Questionnaire design – Meaning - process of designing questionnaire. Secondary data -Sources – advantages and disadvantages.

Measurement and Scaling Techniques: Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert's Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling

Unit5: (10 hours)

Hypothesis - types, characteristics, source, formulation of hypotheses, errors in hypotheses. Parametric and Non-Parametric Tests- t-test, z-test, f-test, u-test, K-W Test (problems on all tests) Statistical analysis- Bivariate and Multivariate Analysis- (only theory). ANOVA-one-way and two-way classification (theory only)

Unit6: (8 hours)

Data Analysis and Report Writing: Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- **Report writing and presentation of results:** Importance of report writing, types of research report, report structure, guidelines for effective documentation.

Practical Components:

- To identify research problem and collect relevant literatures for data analysis
- To write the research design by using Exploratory and Descriptive Research methods
- To prepare the questionnaire on brand awareness, effectiveness of training in public sector organization, Investors attitude towards Mutual funds in any financial institutions.
- To conduct Market survey and to investigate consumer perception towards any FMCG.
- To demonstrate Report writing and Presentation methods

RECOMMENDED BOOKS

- Business Research Methods: A South-Asian Perspective with course Mate William G.Zikmund/Barry J.Babin/Jon C.Carr/AtanuAdhikari/Mitch Griffin, Cengage learning
- Business Research Methods: S.N.Murthy&U.Bhojanna. Excel Books
- Business Research Methods. Donald R. Cooper & Pamela s Schindler, 9/e, TMH /2007
- Research Methods – M MMunshi& K Gayathri Reddy, Himalaya Publishing House, 2015
- Research Methods for Business, Uma Sekaran& Roger Bougie, 6th Edition, Wiley, 2013
- Business Research Methods-SL Gupta and HeteshGuptha, McGraw hill - 2012
- Marketing Research- Naresh K Malhotrs- 5th Edition, Pearson Education /PHI 2007

REFERENCE BOOKS

- Research Methods- William M C Trochi,- 2/e, Biztantra, 2007

- Methodology of Research in social Sciences- O R Krishnaswami, M Ranganatham, HPH, 2007
- Research Methodology – C.R.Kothari, VishwaPrakashan
- Business Research Methodology – J K Sachdeva – 2nd Edition - HPH, 2011
- Research Methodology – concepts and cases – Deepak Chawla and NeenaSondhi -Vikas Publication - 2014

BUSINESS LAW AND POLICY

Subject Code	: 16MBA24	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the legal environment of business and complexities faced by businesses.
- To learn various legal provisions under Indian Companies Act.
- To understand the importance of Corporate Social Responsibility

Course Outcome:

At the end of the course students will be able to:

- Demonstrate awareness towards legal and regulatory context of business
- Recognize and appropriately respond to ethical, legal and strategic concerns relating to human resource and organizational management.
- Gain insights into various acts and understand the significance of corporate governance

Unit 1

(10 Hours)

Indian Contract Act, 1872-meaning of contract, agreement, essential elements of a valid contract. Law of agency-meaning, creation and termination of agency. Bailment and Pledge-meaning rights and duties of bailor and bailee.

Unit 2:

(10 Hours)

Companies Act 1956- Meaning and features, kinds of companies, registration and incorporation, Memorandum of Association,& Articles of Association, Prospectus. Winding up of companies

Unit 3:

(10 Hours)

Miscellaneous Acts-Meaning, scope and objectives of: (a) Intellectual Property Law (relating to patents, copyrights and trademarks): (b) Consumer Protection Act 1986 and (c) Environment Protection Act 1986,

Unit 4:

(10 Hours)

Indian Partnership Act 1932 - THE NATURE OF PARTNERSHIP- Introduction of a partner- Admission of the partner -Retirement of a partner- Expulsion of a partner - Insolvency a partner - Liability of estate of deceased partner

Unit 5:**(8 Hours)**

Corporate Governance: Introduction, Definition, Issues in corporate governance, relevance of corporate governance, need and importance of corporate governance, benefits of good corporate governance. Obligation to society, investors, employees and customers, managerial obligation, Indian cases

Unit 6:**(8 Hours)**

Corporate Social Responsibility: Types and nature of social responsibilities, CSR principles and strategies, models of CSR, Best practices of CSR, Need of CSR, Arguments for and against CSR, CSR in Indian perspective, Indian examples. Latest trends in CSR

Practical Components:

- Students are expected to study any five CSR initiatives by Indian organizations and submit a report for the same.
- A group assignment on the relationship between Business, Law and Society in Indian context
- Case studies/Role plays related ethical issues in business with respect to Indian context.
- Students to collect, analyse and discuss MA, AA & Prospectus of a company.
- Organize a programme on consumer awareness and consumer rights.

RECOMMENDED BOOKS:

- Business, Government, and Society: A Managerial Perspective, Text and Cases – John F. Steiner, 12/e, McGraw-Hill, 2011.
- Business and Government – Francis Cherunilam, HPH.
- Corporate Governance: principles, policies and practices – Fernando A. C, 2/e, Pearson, 2011.
- Business Ethics and Corporate Governance - Ghosh B. N, Tata McGraw-Hill, 2012.
- Business Law for Managers, Goel P. K, Biztantra, 2012.
- Corporate Social Responsibility: A Study of CSR Practices in Indian Industry, Baxi C. V & Rupamanjari Sinha Ray, Vikas Publishing House, 2012.

REFERENCE BOOKS:

- Business and Society - Lawrence and Weber, 12/e, Tata McGraw- Hill, 2010.
- Business Ethics - Bajaj P. S & Raj Agarwal, Biztantra, 2012.
- Corporate Governance - Keshoo Prasad, 2/e, PHI.
- Corporate Governance, Ethics and social responsibility - Balachandran V, & Chandrashekharan V, 2/e, PHI, 2011.
- Corporate Governance – Machiraju H. R, HPH.
- Business Ethics and Corporate Governance – Prabakaran S, Excel BOOKS.
- Corporate Governance – Badi N. V, Vrinda Publications, 2012.
- Civic Sense – Prakash Pillappa, Excel BOOKS, 2012.

STRATEGICMANAGEMENT

Subject Code	: 16MBA25	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide insights into the core concepts of strategic management.
- To evaluate various business strategies in dynamic market environments.
- To gain insights into various strategic management models

Course Outcome:

At the end of the course students will be able to:

- Formulate a strategic plan that operationalizes the goals and objectives of the firm.
- Use management concepts to analyze complex business situations
- Associate with various Strategic Management models for Business situations
- Ability to evaluate and critique theories and models in corporate environment.

Unit 1

(8 Hours)

Meaning and Nature of Strategic Management, its importance and relevance. Characteristics of Strategic Management. The Strategic Management Process. Relationship between a Company's Strategy and its Business Model.

Unit 2

(8 Hours)

Strategy Formulation – Developing Strategic Vision and Mission for a Company – Setting Objectives – Strategic Objectives and Financial Objectives – Balanced Scorecard. Company Goals and Company Philosophy. The hierarchy of Strategic Intent – Merging the Strategic Vision, Objectives and Strategy into a Strategic Plan.

Unit 3

(10 Hours)

Analyzing a Company's External Environment – The Strategically relevant components of a Company's External Environment – Industry Analysis – Industry Analysis – Porter's dominant economic features – Competitive Environment Analysis – Porter's Five Forces model – Industry driving forces – Key Success Factors – concept and implementation.

Unit 4

(10 Hours)

Analyzing a company's resources and competitive position – Analysis of a Company's present strategies – SWOT analysis – Value Chain Analysis – Benchmarking
Generic Competitive Strategies – Low cost provider Strategy – Differentiation Strategy – Best cost provider Strategy – Focused Strategy – Strategic Alliances and Collaborative Partnerships – Mergers and Acquisition Strategies – Outsourcing Strategies –International Business level Strategies.

Unit 5**(10 Hours)**

Business planning in different environments – Entrepreneurial Level Business planning – Multi stage wealth creation model for entrepreneurs– Planning for large and diversified companies – brief overview of Innovation, integration, Diversification, Turnaround Strategies - GE nine cell planning grid and BCG matrix.

Unit 6**(10 Hours)**

Strategy Implementation – Operationalizing strategy, Annual Objectives, Developing Functional Strategies, Developing and communicating concise policies. Institutionalizing the strategy, Strategy, Leadership and Culture

Practical Components:

- Analysing the Mission and Vision statements of a few companies
- Applying Michael Porter's model to an industry (Retail, Telecom, Infrastructure, FMCG, Insurance, Banking etc)
- Pick a successful growing company. Do a web-search of all news related to that company over a one-year period. Analyse the news items to understand and write down the company's strategy and execution efficiency.
- Pick a company that has performed very badly compared to its competitors. Collect information on why the company failed. What were the issues in strategy and execution that were responsible for the company's failure in the market; Analyse the internal and external factors
- Map out GE 9-cell matrix and BCG matrix for some companies and compare them
- Conduct SWOT analysis of your institution and validate it by discussing with faculty
- Conduct SWOT analysis of companies around your campus

RECOMMENDED BOOKS:

- Strategic Management: A South-Asian Perspective With CourseMate Michael A.Hitt/R.Duane Ireland/ Robert E.Hoskisson/S.Manikutty Edition:9th, Cengage Learning
- Crafting and Executing Strategy, Arthur A.Thompson Jr.,AJ Strickland III, John E.Gamble,18/e,TataMcGrawHill,2012.
- Strategic Management - Analysis, Implementation, Control, Nag A,1/e,Vikas,2011.
- Strategic Management -An Integrated Approach, Charles W.L.Hill,Gareth R.Jones,Cengage Learning.
- Business Policy and Strategic Management, Subba Rao P,HPH.
- Strategic Management, Kachru U,Excel BOOKS,2009.

REFERENCE BOOKS:

- Strategic Management: Concepts and Cases, David R, 14/e, PHI.
- Strategic Management: Building and Sustaining Competitive Advantage, Robert A.Pitts & David Lei,4/e,Cengage Learning.
- Competitive Advantage, Michael E Porter, Free Press NY
- Essentials of Strategic Management, Hunger, J. David,5/e, Pearson.
- Strategic Management, Saroj Datta, jaico Publishing House, 2011.
- Contemporary Strategic Management, Grant,7/e,Wiley India, 2012

- Strategic Management-The Indian Context, R. Srinivasan, 4th edition, PHI

ENTREPRENEURSHIP DEVELOPMENT

Subject Code	: 16MBA26	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To develop and strengthen entrepreneurial quality in students.
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
- To provide insights to students on entrepreneurial opportunities.

Course Outcomes:

At the end of the course students will be able to:

- Display keen interest and orientation towards entrepreneurship
- Develop a business plan
- Become aware about various sources of funding for an entrepreneur including financial institutions, venture capitalists and Angel Investors
- Gain consciousness towards social entrepreneurship and rural entrepreneurship opportunities

Unit 1:

(10 Hours)

Entrepreneur & Entrepreneurship: Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneur - Intrapreneur- an emerging class - Concept of Entrepreneurship - Evolution of Entrepreneurship - Development of Entrepreneurship - Entrepreneurial Culture - Stages in entrepreneurial process.

Unit 2:

(10 Hours)

Business Planning Process: Meaning of business plan - Business plan process - Advantages of business planning - Marketing plan - Production/operations plan - Organization plan - Financial plan - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture.

Unit 3:

(8 Hours)

Institutions supporting Entrepreneurs: Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC - Single Window - Latest Industrial Policy of Government of India

Unit 4:

(8 Hours)

Family Business: Importance of family business - Types - History - Responsibilities and rights of shareholders of a family business - Succession in family business - Pitfalls of the family business - strategies for improving the capability of family business - improving family business performance.

Unit 5:**(10 Hours)**

International Entrepreneurship Opportunities: The nature of international entrepreneurship - Importance of international business to the firm - International versus domestic entrepreneurship - Stages of economic development - Entrepreneurship entry into international business - exporting - Direct foreign investment - barriers to international trade.

Unit 6:**(10 Hours)**

Informal Risk Capital and Venture Capital: Informal risk capital market - venture capital - nature and overview - venture capital process - locating venture capitalists - approaching venture capitalists.

Social Entrepreneurship: Social enterprise-need - types - characteristics and benefits of social enterprises-Social entrepreneurship - Rural entrepreneurship, MSME Policies.

Make-In India, Start-Up India, Stand-Up India.

Case studies in Entrepreneurship Development**Practical Components:**

- Make a business plan for your intended business - talk to bankers to find out what they look for in a business plan - modify accordingly and present it in the class
- Analyze the performance of listed family firms. How is their performance compared to the performance of other firms? Does a family firm successfully manage to create wealth for non-family investors?
- Interview a local entrepreneur to find out his/her major motivations to start a business - which of the skills and characteristics do you find in the entrepreneur?
- Study a local for-profit business and try to list out the positive social impacts of the business
- Visit a trade show and try to compare the marketing activities of various stalls in that show - make a list of good practices you come across in the show
- Choose an NGO in your locality. Interview the founder and present the case in class on the motivations - challenges - ecosystem support and their impacts - arrive at possible solutions and convey back to NGO.

RECOMMENDED BOOKS:

- Entrepreneurship: A South-Asian Perspective – T.V Rao/Donald F.Kuratko, Cengage Learning
- Entrepreneurship Development-Small Business Enterprise-PoornimaCharantimath Pearson Education - 2014
- Entrepreneurship- Rober D Hisrich - Michael P Peters - Dean A Shepherd - 6/e - The McGraw-Hill companies - 2007
- Entrepreneurial Development – M M Munshi, Prakash Pinto & Ramesh Khathri, Himalaya Publishing House -2015
- Entrepreneurship Development - S S Khanka - S Chand Publications

REFERENCE BOOKS:

- Entrepreneurship Theory at crossroads - Mathew J Manimala - 2/e - Biztantra - 2007

- Entrepreneurship Development and Management - Vasant Desai - Himalaya Publishing House - 2007
- Entrepreneurship-Theory and Practice - Raj Shankar Vijay Nicole Imprints Pvt. Ltd - 2006
- Entrepreneurship - Rajiv Roy - 2/e - Oxford University Press 2011
- Entrepreneurship-Principles and Practices - Kurakto - 7/e - Thomson Publication - 2007

SEMESTER III MARKETING SPECIALISATION

CONSUMER BEHAVIOR

Subject Code	: 16MBA MM301	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To understand the concept of consumer behavior, decision making by consumers, behavioral variables and its influences on consumer behavior.
- To comprehend the social and cultural dimensions of consumer behavior.
- To provide an insight of the psychological and behavioral concepts of consumers.

Outcomes:

The student should be able to:

- Explain the background and concepts vital for understanding Consumer Behaviour.
- Identify the role of variables that determines Consumer Behaviour in Social & cultural domain.
- Identifying the psychological and behavioral practices adopted by organizations to enhance the Consumer Behaviour.

Unit 1:

(5 Hours)

Introduction to the study of Consumer Behaviour: Meaning & Definition of CB, Difference between consumer & Customer, Nature & characteristics of Indian Consumers, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.

Unit 2:

(9 Hours)

Role of Research in understanding consumer behaviour: Consumer Research: Consumer Research Paradigms (Qualitative & Quantitative Research Methods) Developing research objectives, collecting secondary data, designing primary research, data analysis and reporting research findings.

Models of Consumer Behaviour: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences: Motivation, Personality, Perception, Learning, Attitude, Communications, External Influences: Social Class, Culture, REFERENCE Groups, Family members.

**SCHEME OF TEACHING AND EXAMINATION
MASTER OF BUSINESS ADMINISTRATION**

I SEMESTER

Subject Code	Title of the Subject	Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
			Lecture	Practical / Field Work / Assignment *	Total		IA	Exam		
16MBA11	Management & Organizational Behaviour	Core Course	3	2	5	3	20	80	100	4
16MBA12	Managerial Economics	Core Course	3	2	5	3	20	80	100	4
16MBA13	Accounting for Managers	Core Course	3	2	5	3	20	80	100	4
16MBA14	Quantitative Methods	Core Course	3	2	5	3	20	80	100	4
16MBA15	Marketing Management	Core Course	3	2	5	3	20	80	100	4
16MBA16	Managerial Communications	Core Course	3	2	5	3	20	80	100	4
	Total		18	12	30		120	480	600	24

* Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.

II SEMESTER

Subject Code	Title of the Subject	Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
			Lecture	Practical / Field Work / Assignment *	Total		IA	Exam		
16MBA21	Human Resource Management	Core Course	3	2	5	3	20	80	100	4
16MBA22	Financial Management	Core Course	3	2	5	3	20	80	100	4
16MBA23	Research Methods	Core Course	3	2	5	3	20	80	100	4
16MBA24	Business Law and Policy	Core Course	3	2	5	3	20	80	100	4
16MBA25	Strategic Management	Core Course	3	2	5	3	20	80	100	4
16MBA26	Entrepreneurship Development	Core Course	3	2	5	3	20	80	100	4
	Total		18	12	30		120	480	600	24

* Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.

**III SEMESTER
(Core Specialisation)**

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing	Finance	Human Resource									
16MBAMM301	16MBAFM301	16MBAHR301	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM302	16MBAFM302	16MBAHR302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM303	16MBAFM303	16MBAHR303	Elective	3	2	5	3	20	80	100	3
16MBAMM304	16MBAFM304	16MBAHR304	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM305	16MBAFM305	16MBAHR305	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM306	16MBAFM306	16MBAHR306	Elective	3	2	5	3	20	80	100	3
16MBAIN307			Internship *	0	8	8	-	50	50	100	4
			Industrial Visit	0	0	0	0	0	00	00	0
				18	12	30		120	480	700	22

* Internship will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester. Total number of teaching hours per week is excluding internship workload.

** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.
Industrial visit is a mandatory activity with zero credits

**III SEMESTER
(Core Specialisation Subjects)**

Marketing Specialisation		Finance Specialisation		Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM301	Consumer Behavior	16MBAFM301	Principles & Practices of Banking	16MBAHR301	Industrial Relations & Legislations
16MBAMM302	Retail Management	16MBAFM302	Investment Banking & Financial Services	16MBAHR302	Recruitment & Selection
16MBAMM303	Services Marketing	16MBAFM303	Investment Management	16MBAHR303	Compensation & Benefits
16MBAMM304	Marketing Research	16MBAFM304	Advanced Financial Management	16MBAHR304	Learning & Development
16MBAMM305	Business Marketing	16MBAFM305	Cost Management	16MBAHR305	Knowledge Management
16MBAMM306	Supply Chain Management	16MBAFM306	Strategic Credit Management	16MBAHR306	Conflict & Negotiation Management

III SEMESTER (Dual Specialisation)

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing & Finance	Finance & HR	HR & Marketing									
16MBAMM301	16MBAFM301	16MBAHR301	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM302	16MBAFM302	16MBAHR302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM303	16MBAFM303	16MBAHR303	Elective	3	2	5	3	20	80	100	3
16MBAFM301	16MBAHR301	16MBAMM301	Foundation Course	3	2	5	3	20	80	100	3
16MBAFM302	16MBAHR302	16MBAMM302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAFM303	16MBAHR303	16MBAMM303	Elective	3	2	5	3	20	80	100	3
16MBAIN307			Internship *	0	8	8	---	50	50	100	4
			Industrial Visit	0	0	0	0	00	00	00	0
				18	12	30		120	480	700	22

* Internship will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester. Total number of teaching hours per week is excluding internship workload.

** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.
Industrial visit is a mandatory activity with zero credits

**IV SEMESTER
(Core Specialisation)**

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing	Finance	Human Resource									
16MBAMM401	16MBAFM401	16MBAHR401	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM402	16MBAFM402	16MBAHR402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM403	16MBAFM403	16MBAHR403	Elective	3	2	5	3	20	80	100	3
16MBAMM404	16MBAFM404	16MBAHR404	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM405	16MBAFM405	16MBAHR405	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM406	16MBAFM406	16MBAHR406	Elective	3	2	5	3	20	80	100	3
16MBAPR407			Project Work *	0	8	8	---	50	150	200	12
										800	30

* Project work will be carried out after third semester and shall be evaluated during fourth semester. The internal assessment will be made for 50 marks. In the examination, the total marks of 150 shall be allotted as follows: 50 marks each for report evaluation by internal and external examiners respectively and remaining 50 marks for the viva voce examination, jointly assessed by internal and external examiners.

**** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.**

IV SEMESTER
(Core Specialisation Subjects)

Marketing Specialisation		Financial Specialisation		Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM401	Sales Management	16MBAFM401	Mergers, Acquisitions & Corporate Restructuring	16MBAHR401	Public relations
16MBAMM402	Integrated Marketing Communication	16MBAFM402	Risk Management and Insurance	16MBAHR402	Workplace Ethics & Value Systems
16MBAMM403	E-Marketing	16MBAFM403	Tax Management	16MBAHR403	International Human Resource Management
16MBAMM404	Strategic Brand Management	16MBAFM404	International Financial Management	16MBAHR404	Organisation Change and Development
16MBAMM405	Rural Marketing	16MBAFM405	Financial Derivatives	16MBAHR405	Strategic Talent Management
16MBAMM406	International Marketing Management	16MBAFM406	Corporate Valuation	16MBAHR406	Personal Growth & Interpersonal Effectiveness

IV SEMESTER
(Dual Specialisation)

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing & Finance	Finance & HR	HR & Marketing									
16MBAMM401	16MBAFM401	16MBAHR401	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM402	16MBAFM402	16MBAHR402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM403	16MBAFM403	16MBAHR403	Elective	3	2	5	3	20	80	100	3
16MBAFM401	16MBAHR401	16MBAMM401	Foundation Course	3	2	5	3	20	80	100	3
16MBAFM402	16MBAHR402	16MBAMM402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAFM403	16MBAHR403	16MBAMM403	Elective	3	2	5	3	20	80	100	3
16MBAPR407			Project Work *	0	8	8	---	50	150	200	12
										800	30

- Project work will be carried out after third semester and shall be evaluated during fourth semester. The internal assessment will be made for 50 marks. In the examination, the total marks of 150 shall be allotted as follows: 50 marks each for report evaluation by internal and external examiners respectively and remaining 50 marks for the viva voce examination, jointly assessed by internal and external examiners.

**** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.**

**IV SEMESTER
(Dual Specialisation Subjects)**

Marketing & Finance Specialisation		Marketing & Human Resources Specialisation		Finance & Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM401	Sales Management	16MBAMM401	Sales Management	16MBAFM401	Mergers, Acquisitions & Corporate Restructuring
16MBAMM402	Integrated Marketing Communication	16MBAMM402	Integrated Marketing Communication	16MBAFM402	Risk Management and Insurance
16MBAMM403	E-Marketing	16MBAMM403	E-Marketing	16MBAFM403	Tax Management
16MBAFM401	Mergers, Acquisitions & Corporate Restructuring	16MBAHR401	Public relations	16MBAHR401	Public relations
16MBAFM402	Risk Management and Insurance	16MBAHR402	Workplace Ethics & Value Systems	16MBAHR402	Workplace Ethics & Value Systems
16MBAFM403	Tax Management	16MBAHR403	International Human Resource Management	16MBAHR403	International Human Resource Management

Plan of action (proposed)

1. Implementation of CBCS for MBA Programme will be effective from next academic year, i.e., 2016-17
2. Review of Scheme of Teaching and Examinations being finalized
3. Award of Credits for various components of MBA Programme
4. Allotment of marks for the subjects/papers, seminar and summer project.
80:20 patterns of marks for external examination and internal (IA) marks respectively is to be adopted for all the subjects, except Internship, for which the pattern will be 50:50 basis for internal and external assessments respectively.

Question paper for theory examination shall consist of Part A and B as under:

- Part A shall consist of 5 questions subdivided into a, b, c in 3+7+10 mixed pattern
- Part B shall be a *compulsory* question on Case study/ Practical problem for 20 marks (may contain a maximum of 4 sub-questions).

IA Pattern: 20 marks in each subject, comprising of 10 marks for tests and 10 marks for assignments/seminars/practical exercises/quiz/oral exams

- Entrepreneurship Development and Management - Vasant Desai - Himalaya Publishing House - 2007
- Entrepreneurship-Theory and Practice - Raj Shankar Vijay Nicole Imprints Pvt. Ltd - 2006
- Entrepreneurship - Rajiv Roy - 2/e - Oxford University Press 2011
- Entrepreneurship-Principles and Practices - Kurakto - 7/e - Thomson Publication - 2007

SEMESTER III MARKETING SPECIALISATION

CONSUMER BEHAVIOR

Subject Code	: 16MBA MM301	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To understand the concept of consumer behavior, decision making by consumers, behavioral variables and its influences on consumer behavior.
- To comprehend the social and cultural dimensions of consumer behavior.
- To provide an insight of the psychological and behavioral concepts of consumers.

Outcomes:

The student should be able to:

- Explain the background and concepts vital for understanding Consumer Behaviour.
- Identify the role of variables that determines Consumer Behaviour in Social & cultural domain.
- Identifying the psychological and behavioral practices adopted by organizations to enhance the Consumer Behaviour.

Unit 1:

(5 Hours)

Introduction to the study of Consumer Behaviour: Meaning & Definition of CB, Difference between consumer & Customer, Nature & characteristics of Indian Consumers, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.

Unit 2:

(9 Hours)

Role of Research in understanding consumer behaviour: Consumer Research: Consumer Research Paradigms (Qualitative & Quantitative Research Methods) Developing research objectives, collecting secondary data, designing primary research, data analysis and reporting research findings.

Models of Consumer Behaviour: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences: Motivation, Personality, Perception, Learning, Attitude, Communications, External Influences: Social Class, Culture, REFERENCE Groups, Family members.

Levels of Consumer Decision Making – Consumer Buying Decision Process, Complex Decision Making or Extensive Problem Solving Model, Low Involvement Decision Making or Limited Problem Solving Model, Routinised Response Behaviour, Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages
Situational Influences- Nature of Situational Influence (The communication Situation, The Purchase Situation, The usage situation, The disposition situation) Situational Characteristics and consumption behaviour (Physical features, Social Surroundings, Temporal Perspectives, Task Definition, Antecedent States.)

Unit 3:

(10 Hours)

Individual Influences on Consumer Behaviour and CRM: Part 1

A) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals.

Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives (Cognitive Preservation Motives, Cognitive Growth Motives, Affective Preservation Motives, Affective Growth Motives).

B) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity (Consumer Innovativeness and related personality traits, Cognitive personality factors, Consumer Materialism, Consumer Ethnocentrism), Brand Personality (Brand Personification, Gender, Geography, Colour), Self and Self-Image (One or Multiple selves, The extended self, Altering the self).

C) Perception: Basics of Perception & Marketing implications, Elements of Perception (Sensation, Absolute Threshold, Differential Threshold, Subliminal Perception), Dynamics of Perception (Perceptual Selection, Perceptual Interpretation, Perceptual Organization, perceived price, perceived quality, price/quality relationship, Perceived Risk, Types of risk, How consumers' handle risk.

Customer Relationship Management

Meaning & Significance of CRM, Types of CRM (Operational, Collaborative, Analytical), Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM

Unit 4:

(08 Hours)

Individual Influences on Consumer Behaviour: Part 2

A) Learning: Elements of Consumer Learning, Motivation, Cues, Response, Reinforcement, Marketing Applications of Behavioural Learning Theories, Classical Conditioning Pavlovian Model, Neo-Pavlovian Model), Instrumental Conditioning, Elaboration Likelihood Model.

B) Attitude: Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models.

C) Persuasive Communication: Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation.

Unit 5:

(12 Hours)

External Influences on Consumer Behaviour

Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India

Culture and Subculture - Major Focus on Indian Perspective

Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour.

Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures

Cross-cultural consumer analysis: Similarities and differences among people, the growing global middle class; Acculturation is a needed marketing viewpoint, applying research techniques Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems.

Groups: Meaning and Nature of Groups, Types

Family: The changing structure of family, Family decision making and consumption related roles, Key family consumption roles, Dynamics of husband-wife decision making, The expanding role of children in family decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications,

Reference Groups: Understanding the power & benefits of reference groups, A broadened perspective on reference groups, Factors that affect reference group influence, Types of reference groups, Friendship groups, Shopping groups, Work groups, Virtual groups, Consumer-action groups, reference group appeals, Celebrities.

Unit 6:

(08 Hours)

Consumer Influence and Diffusion of Innovations

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders

Diffusion of Innovations: Diffusion Process (Innovation, Communication channels, Social System, Time) Adoption Process: Stages, categories of adopters Post Purchase Processes: Post Purchase Processes, Customer Satisfaction, and customer commitment: Post purchase dissonance, Product use and non use, Disposition, Product disposition.

Case studies in Indian context only

(04 Hours)

Practical Component:

- Students can go to malls and unorganized retail outlets and observe the behavior of consumers of different demographic segments while buying different category of goods. Come back to class and present the findings / observations followed with a group discussion.
- Students can prepare a questionnaire and do a survey on consumer buying behavior and present the findings in the class.
- Find three advertisements that appeal to the need for power, affiliation and achievement and discuss their effectiveness. Rewrite these for persons in different levels of Maslow's Hierarchy?
- Meet your friends and conduct a survey to find what are the important factors in their purchase of mobiles, shoes, bags etc. There are now plenty of advertisements regarding most products – how do they deal with this information overload?.

RECOMMENDED BOOKS:

- Consumer Behavior - Leon Schiff man, Lesslie Kanuk, 10/e, Pearson, 2010.
- Consumer Behaviour: A Managerial Perspective, Dr. Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal, 1/e, Cengage Learning
- Consumer Behavior: Building Marketing Strategy – Del I. Hawkins, & Others, 11/e, TMH,
- Consumer behavior - Jay D. Lindquist, Joseph Sirgy, 1/e, Cengage Learning.
- Consumer Behavior in Indian Perspective – Suja Nair, Himalaya Publications

REFERENCE BOOKS:

- Consumer Behavior - Henry Asseal, Cengage Learning.
- Consumer Behavior- Satish K. Batra & S H HKazmi, Excel Books.
- CRM – Alok Kumar, Chhabi Sinha, 7/e, Biztantra.
- Customer Relationship Management - Peru Ahamed & Sagadevan, Vikas Publishing.
- Consumer Behavior – Kumar Rajeev, Himalaya Publisher.

RETAIL MANAGEMENT

Subject Code	: 16MBA MM302	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop an understanding of the contemporary retail management, issues, strategies and trends.
- To highlight the importance of retailing and its role in the success of modern business.
- To acclimatize with the insights of retailing, key activities and relationships.

Outcomes:**The student should be able to:**

- Find out the contemporary retail management, issues, and strategies.
- Evaluate the recent trends in retailing and its impact in the success of modern business.
- Relate store management and visual merchandising practices for effective retailing.

Unit 1:**(8 Hours)**

Introduction and Perspectives on Retailing World of Retailing, Retail management, introduction, meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) - Multichannel Retailing - Customer Buying Behaviour, Historical Perspective, role of retailing, trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario

Unit 2:**(5 Hours)**

Theories of Retailing

Wheel of retailing, The Retail Accordion, Melting Pot Theory, Polarization theory.

Unit 3: (14 Hours)

Retailing strategy for Setting up Retail organization and planning: Retail Market Strategy - Financial Strategy - Site & Locations (Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design.) – Human Resource Management, Information Systems and supply chain management & Logistics.

Retail Pricing and Promotion: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies.

Unit 4: (10 Hours)

Store Management and Visual Merchandising:

Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centres, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of Modern retails –Store Layout, design: Types of Layouts, role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors Customer Service, Planning Merchandise Assortments -Buying systems -Buying merchandise and Retail Communication Mix.

Unit 5: (9 Hours)

Relationship Marketing & International Retailing: Management & Evaluation of Relationships in Retailing, Retail Research in Retailing: Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing, Internationalization of Retailing and Evolution of International Retailing, Motives of International Retailing, International Retail Environment – Socio-Cultural, Economic, Political, Legal, Technological and issues in international retailing

Unit 6: (6 Hours)

Retail Audit and ethics in Retailing

Undertaking an audit, responding to a retail Audit, problems in conducting a retail audit. Ethics in retailing, social responsibility and consumerism

Case Studies (4 Hours)

Practical Components:

- Interview a salesperson in a retail store and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why they chose a sales career, and what does it take to succeed in this profession.
- Go to a kirana store and a supermarket and compare the following: a) store arrangement b) No of brands carried c) pricing policies – are discounts given? d) Service – personal or impersonal? Etc.
- Go to at least three kirana stores in your neighborhood (around 2 kms) and discuss with them the importance of location, pricing, credit policy, etc. What percentages of goods are sold 'loose' in each locality and compare this with the approximate income range of

the customers? What are the retailer's losses when a customer defaults in payment? Does he make up for it by increasing his prices to other customers?

- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. Does this buying behavior also depend on the personality of the individual doing the buying? Or the one doing the selling?
- Student can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.

RECOMMENDED BOOKS:

- Retail Management - Levy & Weitz, 8/e, TMH, 2012.
- Retail Management - Chetan Bajaj, Oxford University press.
- Retailing, James R Carver, Patrick m Dunne, Robert F Lusch, 8/e
- Retail Marketing Management - Dravid Gilbert, 2/e, Pearson Education.
- The Art of Retailing - A. J. Lamba, McGraw Hill.

REFERENCE BOOKS:

- Integrated Retail Management - James R. Ogden & Denise Trodden, Biztantra, Latest Edition.
- Principles of Retail Management - Rosemary Varley, Mohammed Rafiq, Palgrave Macmillan, 2009.
- Managing Retailing - Sinha, Piyush Kumar & Uniyal & Oxford University Press, 2010.
- Retailing Management - Swapna Pradhan, 4/e, TMH, 2012.
- Retail Management: A Strategic Approach - Barry Berman, Joel R. Evans, Pearson.
- Retail Management, Functional Principles and Practices, Gibson G Vedamani, 4th Edition, JAICO Publishing House.
- Retail Management, Global perspective, Dr. Harjith Singh, 3rd Revised Edition, S.Chand.

SERVICES MARKETING

Subject Code	: 16MBA MM303	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To acquaint the students with the characteristics of services and their marketing implications.
- To discuss and conceptualize the service quality, productivity in services, role of personnel in service marketing and to manage changes in the environment.
- To familiarize the students with the GAPS model and strategizing towards closing the GAPS for effective services marketing.

Outcomes:

The student should be able to:

- Develop an understanding about the various concepts and importance of Services Marketing.
- Enhance knowledge about emerging issues and trends in the service sector
- Learn to implement service strategies to meet new challenges

Unit 1: (10 Hours)

Introduction to services: Concepts, contribution and reasons for the growth of services sector, difference in goods and service in marketing, characteristics of services, concept of service marketing triangle, service marketing mix, GAP models of service quality.

Consumer behaviour in services: Search, Experience and Credence property, consumer expectation of services, two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services.

Customer perception of services-Factors that influence customer perception of service, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

Unit 2: (8 Hours)

Understanding customer expectation through market research: Key reasons for GAP 1, using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies –Relationship marketing, Evaluation of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services.

Unit 3: (10 Hours)

Customer defined service standards: “Hard” & “Soft” standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand.

Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies.

Leadership & Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing.

Unit 4: (8 Hours)

Employee role in service designing: importance of service employee, Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.

Customer’s role in service delivery-Importance of customer & customer’s role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies.

Unit 5: (8 Hours)

Role of marketing communication-Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery, Methodology to exceed customer expectation.

Pricing of services-Role of price and value in provider GAP 4, Role of non-monitory cost, Priceas an indicator of service quality –Approaches to pricing services, pricing strategies.

Unit 6: (6 Hours)

Physical evidence in services: Types of service spaces- Role of service scapes, Frame work forunderstanding service scapes& its effect on behaviour-Guidance for physical evidence strategies.

Case Studies in Indian context only (6 hours)

Practical component:

- Ask students to choose a service industry of their choice at the beginning of the semester
- Ask them to do an in-depth study of the industry and give a presentation at the end of theevery Module relating to the concepts of that Module to the industry
- Students can prepare service blueprints for any service of their choice
- Students can do a role play on service recovery
- Identify any existing services. Locate loopholes in their design and suggest modifications

RECOMMENDED BOOKS:

- Services Marketing-Valarie A Zeithmal& Mary Jo Bitner, 5/e, TMH, 2011
- Services Marketing-Christopher Lovelock, Pearson Education.

REFERENCE BOOKS:

- Services Marketing - RajendraNargundkar, 3/e, TMH, 2010
- Services Marketing - GovindApte, Oxford.
- Services Marketing - Hoffman & Bateson, 4/e, Cengage Learning-2007
- Services Marketing: Operation, Management and Strategy-Kenneth E Clow& David L. Kurtz, 2/e, Biztantra, 2007

MARKETING RESEARCH

Subject Code	: 16MBA MM304	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To provide an understanding of the basics of marketing research process.
- To orient on the theoretical and practical aspects of marketing research.
- Encourage the students to take up analytical thinking through research.
- To highlight importance marketing research for enhancing marketing strategies.

Outcomes:

The student should be able to:

- Comprehend the objectives of Market research & its application in solving marketing problems

- Appreciate the use of different data collection methods, sampling design techniques, measurement methods to analyze the data.
- Generalize and interpret the data with the help of various measurement techniques.
- To understand the emergence of new trends in research.

Unit 1: (8 Hours)

Introduction: Meaning, scope and importance of marketing research; own vs. agency marketing research; marketing information system; meaning, need and components, marketing information system and marketing research; marketing research process-an overview; problem definition, formulation and preparation of research proposal.

Unit 2: (10 Hours)

Research Design and Data Collection

Research Design: Meaning and scope of research design; types of research designs, exploratory, descriptive and conclusive

Secondary Data: Sources and uses of secondary data, collection of secondary data.

Primary Data Collection: Primary data collection methods; mail survey, telephone survey and interviews and their evaluation; observations; experimental methods, questionnaire administering, organizing fieldwork for collecting data.

Unit 3: (9 Hours)

Sample Design and Sampling: Determining universe, sampling frame and sampling unit; determining sampling method; sample size determination; sampling errors vs. non-sampling errors.

Sampling: Steps & Types: Probability / non probability (simple, systematic; stratified proportionate, disproportionate), Sample size determination

Unit 4: (9 Hours)

Questionnaire design:-Steps in Q.D. with examples for each step. Rating Scales, Juster, Likert, Semantic Differential, Thurston, Attitude Scales, Scales for illiterate respondents

Unit 5: (10 Hours)

Measurement Techniques: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale; Scale Types: Comparative Scaling, Non-comparative Scaling; Attitude Measurement, Self-Reporting Methods, Methods for Rating Attributes, Data Analysis, Customer Research, Advertising Research, Product Research, Distribution Research, Sales Research, Marketing Environment Research, Internet Marketing Research, and International Marketing Research

Unit 6: (10 Hours)

Research trends, Behavioral Science Based Approach, Economic and Competitive Pressures, Consumer Insight Groups, Quantifying Emotions, Impact of the Social Media, Do-it-Yourself (DIY) Research; Research ethics, typical research errors, Research and culture;

Practical Components:

- Choose 5 successful products or services and identify the insight behind them through a field survey.
- Do a comprehensive essay on the difference between consumer vs. trade vs. competition insights & how best to exploit them.
- Take 5 recent digital innovations e.g. twitter or face book and identify the insights. Locate 5 non-users of search or mail and Interview their reasons.
- Choose 5 recent successful campaigns and identify their insights through consumer interviews. Present your findings to the class
- Choose 3 successful movies e.g. Dabang & Zindaginamilegi & My name is Khan---and interview consumers about the reasons for their success. Similarly repeat this with 3 recent expensive flop movies and Present your findings to the class

RECOMMENDED BOOKS:

- Marketing Research contemporary approach- Naraynreddy and GVRK Acharyalu, Excel publications
- Marketing Research and consumer Behavior Saravanel et.al, Vikas publishing house
- Essentials of Marketing Research – 4/e, Tony Proctor, PHI, 2005
- Essentials of Marketing Research – William G. Zikmund et.al. 4/e, Cengage Learning, 2010.
- Research Skills for Students: Transferable and Learning Skills - Allison, et.al. 1996.
- Market Research – Aekar, 11/e, Wiley publications, 2002.

REFERENCE BOOKS:

- Market Research: a guide to planning, methodology & evaluation - Paul Hague, KoganPage, 1996.
- Market Research Best Practice. 30 Visions of the Future – Peter Mouncey, et.al, 2007.

BUSINESS MARKETING

Subject Code	: 16MBA MM305	IA Marks: 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop an understanding of the various concepts of Industrial Marketing.
- To understand the buying process and marketing channels for industrial goods.
- To acquaint with B-2-B-2-C Strategies and their implementation.
- To analyze various pricing strategies of industrial goods & their implications.
- To understand the significance of E-commerce in Business Marketing.

Outcomes:

The student should be able to:

- Describe the nature of business markets and the related concepts.
- Familiarize the business buying behavior of industrial customers.
- Analyze business situations in the context of buyer-seller relationships.
- Apply concepts of pricing strategies for industrial goods

- To evaluate the significance of E –Commerce in Business Marketing.

Unit 1: (8 Hours)

Nature of Business Marketing: Business Marketing Concept, Business vs. Consumer Marketing, Economics of Industrial demand, Types of Industrial Markets, Types of Business Customers, Classifying Industrial Products & Services, Business customers purchase orientations, Organizational Procurement Characteristics, Environment Analysis in Business Marketing.

Units 2: (10 Hours)

Organizational Buying Behaviour: Organizational Buying Process, Types of purchases / buying situations, Buying Centre Concept, Inter Personal Dynamics of Business Buying Behaviour, Roles of Buying centre, Conflict Resolution in Decision, The Webster & Wind model of Organizational Buying Behaviour, Ethics in Purchasing.

Business Marketing Research: Differences between B2C & B2B Marketing Research, Marketing Research Process, The Standard Industrial Classification (SIC), Research Methods, Sales Forecasting Approaches, Top-Down, Bottom-up approaches.

Unit 3: (8 Hours)

Market Segmentation: Segmenting, Targeting and Positioning of Business Market, Value based segmentation, Model for segmenting the organizational Market.

Product & Brand Strategy: Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products, Branding process & Brand strategy.

Business Service Marketing: Special Challenges

Unit 4: (8 Hours)

Formulating Channel Strategy: Nature of Business Marketing channels, Intermediaries, Direct and Indirect Channels, Channel Objectives, Channel Design, Managing Channel Members, Selection and Motivation of Channel Members, Channel conflicts, SCM, Logistics Management, Customer Service, Major cost centres of Market Logistics.

Unit 5: (8 Hours)

Pricing Strategies: Price Determinants, Factors that Influence the Pricing Strategies, Pricing Methods, concept of learning curves, Pricing Strategies, Pricing Policies, Terms of Payment, Competitive Bidding, Leasing

The Promotional Strategies: Communication Objectives, Role of B-2-B Advertising, Sales Promotion in Industrial Markets, Trade shows and Exhibitions.

Unit 6: (10 Hours)

Management of Sales Force: Personal Selling, The Selling Process, Key Account Management, Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for sales force Deployment, Measuring the Effectiveness of Sales Force, Customer relationship Management Strategies for Business Markets, Ethical Issues.

B2B through E-Commerce: Business-to-Business forms of E-Commerce, Models for B2B ecommerce, Marketing strategy for the electronic market place.

Case Studies in Indian context only.

(4 Hours)

Practical Components:

- Group presentations on organizational buying behavior & practices in purchase of raw materials, capital & facilitating goods in Indian Co's & MNC's operating in India.
- Segmentation & Positioning of B2B Products.
- Forecasting Techniques for demand of Industrial Products
- Visit to Trade shows & Exhibitions
- Industry visit in 2-3 Industries
- Competitive Bidding Process
- Preparation of quotation.
- Industry survey in the context of B2B Marketing
- Case studies

RECOMMENDED BOOKS:

- Business Marketing – Krishna K Havaldar, Latest Edition, Tata McGraw Hill Publication.
- Industrial Marketing – Robert R Reeder & Reeder; 2nd Edition; Prentice-Hall International Publication.
- Business Marketing Management – Michael D Hutt, Thomas W Speh, Latest Edition, Cengage Learning Publication.

REFERENCE BOOKS:

- Business Marketing – Frank G Bingham Jr., Latest Edition; Tata McGraw Hill Publication.
- Industrial Marketing – Mukherjee H S; Latest Edition; Excel BOOKS Publication.
- Industrial Marketing – PK Ghosh, Latest Edition; Oxford University Press.

SUPPLY CHAIN MANAGEMENT

Subject Code	: 16MBA MM306	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives:

- To understand the basic concepts, processes and key elements of a supply chain.
- To provide insights for establishing efficient, effective, and sustainable supply chains.
- To explain the role of technology in supply chain planning, visibility, and execution.

Outcomes:

The student should be able to:

- Demonstrate knowledge of the functions of logistics and supply chain management.
- To relate concepts and activities of the supply chain to actual organizations.
- Highlight the role of technology in logistics and supply chain management.

- Evaluate cases for effective supply chain management and its implementation.

Unit 1: (7 Hours)

Introduction: Basic concepts & philosophy of SCM, essential features, decision phases – process view, supply chain framework, key issues in SCM and benefits.

Unit 2: (8 Hours)

Designing the supply chain network: Designing the distribution network, role of distribution, factors influencing distribution, design options, distribution networks in practice, network design in the supply chain, factors affecting the network design decisions. Designing and Planning Transportation Networks, role of transportation, modes and their performance, transportation Infrastructure and policies, design options and their trade-offs, tailored transportation.

Unit 3: (10 Hours)

Inventory Management: Concept, various costs associated with inventory, EOQ, buffer stock, lead time reduction, reorder point / re-order level fixation, ABC analysis, SDE/VED Analysis. [Simple problems only for understanding the concept]

Unit 4: (8 Hours)

Purchasing and vendor management: Centralized and decentralized purchasing, function of purchase department and purchase policies, vendor rating/ evaluation, single vendor concept, management of stores, account for materials, just in time & Kanban systems of inventory management

Unit 5: (10 Hours)

Logistics Management: Logistics of part of SCM, logistics costs, different models, logistics, sub-systems, inbound and out bound logistics bullwhip effects in logistics, distribution and warehousing management. Demand Management and Customer Service: Demand Management, traditional forecasting, CPFRP, customer service, expected cost of stockouts.

Unit 6: (8 Hours)

Recent issues in SCM: Role of computer/ IT in supply chain management, CRM Vs SCM, Benchmarking concept, features and implementation, outsourcing – basic concepts, value addition in SCM – concept of demand chain management

Case Studies in Indian context only. (5 Hours)

Practical Components:

- Students are expected to choose any 2 Indian Organization and study their supply chain in terms of drivers of the Supply chain and submit a report
- Students can study different logistics companies and services provided by them.
- Students can identify any product/service and study the type of distribution system used and understand the reason for using that particular type.
- Students can identify the various types of IT applications employed by Indian Organizations in their Supply chain.

RECOMMENDED BOOKS:

- Supply chain management, Chopra Sunil and Peter Meindl - 3rd edition, Pearson, 2007.
- A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, 1st Edition, Cengage Learning.
- Supply Chain Logistics Management, Donald J Bowersox, Dand J Closs, M Bixby Coluper, 2nd Edition, TMH, 2008.
- Supply Chain Management-A Managerial Approach, Amith Sinha, Herbert, 2nd edition, TMH.

REFERENCE BOOKS:

- Logistics and supply chain management, G. Raghuram (I.I.M.A.), Macmillan, 2000
- Harnessing value in supply chain, Emiko Bonafield, Johnwiley, Singapore, 1999
- Material Management rearview, Dr. Gopal Krishnan, Pearson New Delhi, 2002
- Supply Chain Management, B.S. Sahay, Macmillan, Pearson Education, 2004
- A Text Book of Logistics and Supply chain management, Agarwal D.K. - 1st edition, Macmillan.

Semester: III Finance Specialisation

PRINCIPLES AND PRACTICES OF BANKING

Subject Code	: 16MBA FM301	IA Marks: 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To discuss the Structure and System of Banking in India
- To discuss the features of Negotiable Instrument Act of 1881
- To familiarize the students with Universal Banking
- To discuss the Asset Liability Management in banks

Course Outcomes:

At the end of the course students are able to:

- Understand the banking system in India
- Know the nature of banker – customer relationship
- Make use of Negotiable instruments practically
- Have familiarity in using banking technologies like internet banking, Mobile banking, NEFT, ECS etc.
- Understand the concept of international banking and management of asset and liability in banks

Unit 1:**(10 Hours)**

Banking system and structure in India- Evolution of Indian Banks-Types of banks - Public Sector, Regional Banks, Performance of Public Sector banks, Private Sector Banks.

Commercial banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio economic development, Services rendered. Credit creation and Deployment of

Funds.-Role of Reserve Bank and GOI as regulator of banking system – Provisions of Banking Regulation Act & Reserve Bank of India Act.

Unit 2: (10 Hours)

Banker and customer – Types of relationship between banker and customer – Bankers obligations to customers – Right of lien, setoff, appropriation–Bankers legal duty of disclosure and related matters.

Customers` accounts with banks – Opening- operation – KYC norms and operation –Types of accounts and customers – Nomination – Settlement of death claims.

The Negotiable Instruments Act 1881: The Paying Banker and The Collecting Banker- Negligence-Bills of exchange and promissory note-Discharge of Negotiable instruments- Hundis.

Unit 3: (10 Hours)

Banking Technology- Concept of Universal Banking-Home banking–ATMs-Internet banking– Mobile banking-Core banking solutions–Debit, Credit and Smart cards– Electronic Payment systems-MICR- Cheque Truncation-ECS- EFT – NEFT-RTGS.

Unit 4: (9 Hours)

International banking–International Banking: Exchange rates and Forex Business, Correspondent banking and NRI Accounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers, Role of ECGC, RBI and EXIM Bank.

Unit 5: (8 Hours)
Banker as lender – Types of loans – Overdraft facilities – Discounting of bills – Financing book dates and supply bills- Charging of Security bills- pledge – mortgage – assignment

Unit 6: (9Hours)

Asset Liability Management (ALM) in banks: Components of Liabilities and Components of Assets, Significance of Asset Liability management, Purpose and objectives. Prerequisites for ALM, Assets and Liabilities Committee (ALCO)- Activities of ALCO

Practical Components:

- Students can study Universal Banking & Cross Selling concepts adopted by banks
- Students can study Customer Profiling aspects adopted by banks
- Students can analyze Advertisement & Publicity efforts done by banks using ATMs (making a checklist of the publicity material found in an ATM – preferably in a private bank ATM)

RECOMMENDED BOOKS:

- Principles and practices of Banking - IIBF, 2/e, Macmillan, New Delhi.
- Elements of Banking & Insurance – JyothsnaSethi&Nishwan Bhatia, PHI, 2009.
- Bank Management - Koch W, Timothy, & S. Scott, Cengage Learning, New Delhi.

- Management of Banking and Financial Services, Padmalatha Suresh and Justin Paul, Second edition, Pearson, 2011
- Banking Theory and Practice, K.C. Shekhar and LekshmyShekhar, Vikas Publishing House,2011.
- Modern Banking: Theory and Practice, Muraleedharan D, PHI,2013.

REFERENCE BOOKS:

- Banking Theory, Law and practice - Sunderaram and Varshney, Sultan Chand & Sons, New Delhi.
- Banking and Financial System - Prasad K, Nirmala, Chandradas J. Himalaya Publishing House, Mumbai.
- Banking and Financial services- Sharma, Mukund, 1st edition, Himalaya Publishing House, Mumbai.

INVESTMENT BANKING AND FINANCIAL SERVICES

Subject Code	: 16MBA FM302	IA Marks: 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To provide an understanding of the functioning of investment banking
- To explain the role of depositories and custodians
- To provide an in depth understanding of the financial services like factoring, venture capital, leasing and hire purchase.
- To familiarize the students with working of Housing finance and non banking finance companies
- To explain the concept and developments in micro finance, credit rating and securitization

Course Outcome:

At the end of the course, the students are able to:-

- Understand the functioning of Investment banking
- Be aware of operation connected with depositories and custodians
- Know how financial services like factoring, venture capital, leasing and hire purchase are provided in the financial system.
- Understand the working of Housing finance and non-banking finance companies.
- Identify the developments happening in micro finance, credit rating and securitization system.

Unit 1:

(10 Hours)

Investment Banking- Introduction-Functions of Investment Banks- Types of Investment Banks- Investment Banking Services- Merchant Banking Services-Issue Management-Pre issue and Post

issue obligations-Changing landscape of Investment Banking. Regulation of the Capital Market-SEBI regulations for merchant bankers, brokers and sub brokers, intermediaries and portfolio managers.

Underwriting: Concept – Devolvement - Business model - Underwriting in fixed price offers and book built offers.

Unit 2: (9 Hours)

Depository System: Objectives, activities, interacting systems, role of depositories and their services, Advantages of depository system -NSDL and CDSL. The process of clearing and settlement through Depositories, Depository Participants.

Regulations relating to Depositories-SEBI (Depositories and Participants) Regulations 1996-Registration of depository and participant- Rights and Obligations of depositories and Participants.

Unit 3: (7 Hours)

Housing Finance: Role, Types of housing loans, Institutions and banks offering Housing Finance, Procedure and Interest rates. Income Tax Implication. Reverse mortgage loan.

Non-Banking Finance Companies: Types, Growth, Functions, RBI Guidelines, Prudential Norms.

Unit 4: (9 Hours)

Factoring: Origin, Types, Factoring mechanism, advantages, factoring charges, International factoring, Factoring in India. **Forfeiting:** Origin, characteristics, benefits, difference between factoring and forfeiting, growth of forfeiting in India. **Securitization of debt:** Meaning, Features, Special Purpose Vehicle, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.

Unit 5: (9 Hours)

Venture Capital: Concept, features, Origin and the current Indian Scenario. Private equity-Investment banking perspectives in private equity

Microfinance: The paradigm - NGOs and SHGs - Microfinance delivery mechanisms – Future of micro finance.

Credit rating: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of different companies. Rating agencies for SMEs.

Unit 6: (12 Hours)

Leasing: Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and disadvantages of Leasing, Contents of a Lease Agreement, Matters on Depreciation and Tax, Problems in leasing, Factors influencing Buy or Borrow or Lease Decision.

Hire Purchasing: Concepts and features, Hire Purchase Agreement, Comparison of Hire Purchase with Credit sale, Instalment sale and Leasing. Banks and Hire Purchase. Problems related to outright purchase, Hire purchase and Leasing.

(Question Paper: Case study-Problem on financial evaluation of leasing and hire purchase.)

Practical Components:

- Students can study the procedure for the sanction of housing loans by a bank
- Students can study the Procedure to open a Demat account and an Online Trading Account.
- Students can visit a NBFC and study their operations
- Students may visit a SHG/NGO and study the micro finance aspects
- Visit a bank/financial institution providing factoring service and submit a report.

RECOMMENDED BOOKS:

- Indian Financial System—Khan M. Y, 7/e, TMH, 2011
- Indian Financial System – Machiraju, 4/e, Vikas, 2010
- Financial Markets and Services – Gordon & Natarajan, 7/e, Himalaya publishing, 2011.
- Financial services - Khan M.Y, 6/e, McGraw Hill, 2011.
- Banking and Financial services- Sharma, Mukund, 1/e edition, Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:

- Dynamics of Financial Markets and Institutions in India – Srivastava R. M, Excel Books, 2010.
- Indian Financial System – Bharati V. Pathak, 3/e, Pearson Education, 2011.
- Investment Banking- Pratap G Subramanyam, Tata McGraw Hill, 2012.
- Merchant Banking & Financial services - Vij&Dhavan, 1/e, McGraw Hill, 2011.

INVESTMENT MANAGEMENT

Subject Code	: 16MBA FM303	IA Marks: 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop a thorough understanding of the process of investments.
- To familiarize the students with the stock markets in India and abroad.
- To provide conceptual insights into the valuation of securities.
- To provide insight about the relationship of the risk and return and how risk should be measured to bring about a return according to the expectations of the investors.
- To familiarize the students with the fundamental and technical analysis of the diverse investment avenues
- To learn the Theories of Portfolio management and also the tools and techniques for efficient portfolio management.

Course Outcome:

At the end of the course, the students are able to:-

- Understand the process of investments.
- Get an insight into functioning of stock markets in India and abroad.
- Have insight into the relationship of the risk and return.
- Have familiarity of the fundamental and technical analysis
- Learn the Theories of Portfolio management and also the tools and techniques for efficient portfolio management.

Unit 1: (Theory)

(6 Hours)

Investment: Attributes, Economic vs. Financial Investment, Investment and speculation, Features of a good investment, Investment Process. Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives. Mutual Funds: Functions of Investment companies, Classification of Investment companies, Mutual Fund types, Performance of Mutual Funds-NAV.

Unit 2: (Theory)

(6 Hours)

Securities Market: Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures, Leading Stock Exchanges in India. Stock Market Indicators- Types of stock market Indices, Indices of Indian Stock Exchanges.

Unit 3: (Theory & Problems)

(10 Hours)

Risk and Return Concepts: Concept of Risk, Types of Risk- Systematic risk, Unsystematic risk, Calculation of Risk and returns of individual security, Portfolio Risk and Return

Unit 4: (Theory & Problems)

(10 Hours)

Valuation of securities: Bond- Bond features, Types of Bonds, Determinants of interest rates, Bond Management Strategies, Bond Valuation, Bond Duration. Preference Shares- Concept, Features, Yields. Equity shares- Concept, Valuation, Dividend Valuation models

Unit:5 (Theory& Problems)

(12 Hours)

Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Global Economy, Domestic Economy, Business Cycles, Industry Analysis.

Company Analysis- Financial Statement Analysis, Ratio Analysis.

Technical Analysis – Concept, Theories- Dow Theory, Eliot wave theory. Charts-Types, Trend and Trend Reversal Patterns. Mathematical Indicators – Moving averages, ROC, RSI, and Market Indicators. (Problems in company analysis & Technical analysis)

Market Efficiency and Behavioral Finance: Random walk and Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency. Behavioral Finance – Interpretation, Biases and critiques. (Theory only)

Unit 6: (Theory & Problems)

(12 Hours)

Modern Portfolio Theory: Markowitz Model -Portfolio Selection, Opportunity set, Efficient Frontier. Capital Asset pricing model: Basic Assumptions, CAPM Equation, Security Market line, Extension of Capital Asset pricing Model - Capital market line, SML VS CML. Arbitrage Pricing Theory: Arbitrage, Equation, Assumption, Equilibrium, APT AND CAPM.

Portfolio Management: Diversification- Investment objectives, Risk Assessment, Selection of asset mix, Risk, Return and benefits from diversification. Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans.

Portfolio Evaluation: Holding period's returns, Measures of portfolio performance. Sharpe's, Treynor's and Jensen's.

(QUESTION PAPER- 50% Problems, 50% Theory)

Practical Components:

- A Student is expected to trade in stocks. It involves an investment of a virtual amount of Rs.10 lakhs in a diversified portfolio and managing the portfolio. At the end of the Semester the Net worth is to be assessed and marks may be given (to beat an index).
- Students should study the functioning of stock exchange.
- Students can do:-
 - Macro Economic Analysis for the Indian economy.
 - Industry Analysis for Specific Sectors.
 - Company Analysis for select companies.
 - Practice Technical Analysis
- Students can study the mutual funds schemes available in the market and do their Performance evaluation.

RECOMMENDED BOOKS:

- Investments – ZviBodie, Kane, Marcus &Mohanty, 8/e, TMH, 2010.
- Investment Analysis and Portfolio management – Prasanna Chandra, 3/e, TMH, 2010.
- Security Analysis & Portfolio Management- Kevin S, PHI, 2011.
- Investment Management – Bhalla V. K, 17/e, S.Chand, 2011.
- Security Analysis & Portfolio Management – Fisher and Jordan, 6/e, Pearson, 2011.
- Security Analysis & Portfolio Management – Punithavathy Pandian, 2/e, Vikas, 2005.
- Investment Management – Preethi Singh, 17/e, Himalaya Publishing House 2010.

REFERENCE BOOKS:

- Fundamentals of Investment – Alexander, Sharpe, Bailey, 3/e, PHI, 2001.
- Security Analysis & Portfolio Management – Nagarajan K &Jayabal G , 1st Edition, New Age international, 2011.
- Security Analysis & Portfolio Management– Dhanesh Khatri, 1st Edition, Macmillan, 2010.
- Security Analysis & Portfolio Management– Talwar, 1st Edition, Cengage, 2016.

ADVANCED FINANCIAL MANAGEMENT

Subject Code	: 16MBA FM304	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the management of working capital.
- To understand the techniques of cash, inventory and receivables management
- To comprehend the capital structure
- To assess the dividend policy of the firm

Course Outcome:

At the end of the course, the students are able to:

- Realize the importance of management of working capital in an organization.
- Be aware of the techniques of cash, inventory and receivables management
- Get an overview of capital structure theories
- Understand and assess the dividend policy of the firm

Unit 1: (8 Hours)

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage.

Unit 2: (10 Hours)

Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund.

Unit 3: (9 Hours)

Receivables Management – Credit management through credit policy variables, marginal analysis, Credit evaluation: Numerical credit scoring and Discriminate analysis. Control of accounts receivables, Problems on credit granting decision.

Unit 4: (9 Hours)

Inventory Management: Determinations of inventory control levels : ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis.

Unit 5: (10 Hours)

Capital structure decisions – capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Arbitrage process in capital structure. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy

Unit 6: (10Hours)

Dividend policy – Theories of dividend policy : relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. Legal and procedural aspects of dividends Corporate Dividend Tax.

(Question paper: 40% theory and 60% problems)

Practical Components:

- Study the working capital financing provided by a Bank and submit the report on the same
- Study the annual report of any two companies and prepare a cash budget for next year.
- Study dividend policy of companies and its impact on shareholders' wealth
- Study implications of bonus issues/stock splits of companies

RECOMMENDED BOOKS:

- Financial Management - M.Y. Khan & P.K. Jain, 6/e, TMH, 2011
- Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
- Financial Management - I.M. Pandey, 10/e, Vikas, 2011.
- Financial Management: Comprehensive Text Book with Case Studies – Ravi M. Kishore, 7/e, Taxmann.
- Principle of Corporate Finance– Brearly and Myers, 10/e, TMH, 2012

REFERENCE BOOKS:

- Financial Management: Theory & Practice - Brigham & Ehrhardt, 10/e, Cenage Learning, 2004.
- Corporate Finance: Ross, Westerfield & Jaffe, – TMH – 8/e, 2010
- Financial Management & Policy - Vanhorne, 12/e, Pearson
- Corporate Finance: Theory & Practice – Ashwath Damodaran, 2/e, Wiley India Pvt. Ltd., 2009.
- Cases in Financial Management - Pandey & Bhatt, 2/e, TMH, 2012.

COST MANAGEMENT

Subject Code	: 16MBA FM305	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To describe the cost concepts, cost behaviors, and cost accounting techniques that are applied to manufacturing and service businesses
- To provide an understanding of the use of cost information in support of different strategies
- To demonstrate costing methods and techniques appropriate to a variety of businesses
- To prepare and interpret budgets and operating results through variance analysis
- To describe the use of balanced scorecard and explain how the balanced scorecard supports strategic cost management

Course Outcome:

At the end of the course, the students are able to :

- Understand the cost concepts, cost behaviors, and cost accounting techniques
- Get an insight into the use of cost information in support of different strategies

- Comprehend costing methods and techniques appropriate to a variety of businesses
- prepare and interpret budgets and operating results through variance analysis

Unit 1:(10 Hours)

Introduction to Cost Management- Cost Accounting to Cost Management- Elements of costs- Classification of costs-Methods of costing-Cost Management Tools- A Strategic View to Cost Management- Preparation of a cost sheet

Unit 2:(10 Hours)

Overheads, Classification and Collection, Difference between Cost Allocation and Cost Apportionment, (Full fledged Problems on Primary and secondary distribution, Simultaneous equations, Absorption of Overhead, Theory on Under and Over absorption of Overhead)

Unit 3:(10 Hours)

Marginal Costing – Nature and Scope- Applications-Break even charts and Point, Decision Making (all types with full problems) Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing.

Unit 4:(10 Hours)

Budgetary Control:- Objectives of Budgetary control, Functional Budgets, Master Budgets, Key Factor Problems on Production Budgets and Flexible Budgets.

Standard Costing:- Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labour variances only .

Unit 5:(8 Hours)

Demerits of Traditional Costing, Activity Based Costing, Cost Drivers, Cost Analysis Under ABC (Unit level, Batch Level and Product Sustaining Activities), Benefits and weaknesses of ABC

Unit 6: (8 Hours)

Cost Audit& Reporting to Management:-objectives and advantages of Cost Audit , Cost Audit report .Management Audit- Objectives and Scope.

Reporting to Management – Purpose of reporting-Requisites of a good report,, Classifications of Report, Segment reporting, Cost Reduction and Cost Control, Target Costing – its Principles, Balanced Scorecard: Features and Purpose

(Question Paper:50% Theory and 50% Problems)

Practical components:

- Students can take up a product and get details about the actual cost of raw material, wages and other cost and prepare a cost statement. Standard cost of each component has to be obtained and the variance can be calculated to find the efficiency of Purchase, Operations and Production in charge.

RECOMMENDED BOOKS:

- Cost Accounting – Khan M. Y and Jain P. K, TMH.
- Management Accounting - Khan M. Y and Jain P. K, 6th Edition, McGraw Hill, 2012.
- A Text book of Cost and Management Accounting – Arora M. N, 11th Edition, Vikas.
- Cost Management: A strategic Approach - Vaidya S. C, Suveera Gill, Macmillan, 2010.
- Cost Accounting- Jawaharlal, & Seema Srivastava, 4th Edition, TMH.
- Accounting & Costing for Management – Sinha P. K, Excel Books, 2010.
- A Textbook of Cost Management- G.V Kesava Rao, D Gopinath, M.G. Krishnamurthy and Anita S. Yadav, Paramount Publishing House, 2013

REFERENCE BOOKS:

- Principles and Practice of Cost Accounting - Bhattacharyya, 3rd Edition, PHI.
- Managerial Accounting- James Jiambalvo, 4nd Edition, Wiley India Pvt. Ltd.
- Advanced Cost Accounting – Madegowda J, HPH.
- Cost and Management Accounting – Arora M. N, 3rd Edition, HPH.
- Cost Accounting: Theory and Practice - Bhabatosh Banerjee, 13th Edition, PHI.

STRATEGIC CREDIT MANAGEMENT

Subject Code	: 16MBA FM306	IA Marks	:20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide an overview of the sound lending decisions by a bank
- To explain the process of evaluation of the loan proposal
- To provide an insight into the different types of loans
- To describe the aspects of NPA management

Course Outcome:

At the end of the course, the students are able to:

- Understand and evaluate the lending decisions by a bank
- Realize the process of evaluation of the loan proposal by banks
- Get an insight into the different types of loans
- Understand management of NPA

Unit 1:**(10 Hours)**

Credit management in banks-Screening of applications-Appraisal of credit-Sanction limit-Post sanction compliance – Monitoring supervision –Review- Government policies for credit extension- Credit institutions- Principles of good lending- Borrower study and bankers opinion-Credit policy by banks- Government regulation of credit -Prudential norms.

Unit 2: (10 Hours)

Over view of credit policy and loan characteristics-The credit process –Characteristics of different types of loans- Evaluating commercial loan requests – Financial statement analysis- Cash flow analysis- Projections-Management of the firm and other factors –Feasibility study – Fundamental credit issues - Credit analysis-Different types of borrowers – Balance sheet analysis for lending – Forms of advances secured and unsecured advances- Short term and long term advances.

Unit 3: (8 Hours)

Evaluating consumer loans – Types- Credit analysis of consumer loans- Risk–return analysis of consumer loans- Customer profitability analysis and loan pricing- Fixed Vs floating rates

Unit 4: (8 Hours)

Loan and advances against pledge- Hypothecation- Mortgage – Lien- Advances against goods- Document to title to goods – Life insurance policies – Stock exchange securities-Fixed deposit receipts –Book debts- Supply bills- Real estates – Advance against collateral securities

Unit 5: (8 Hours)

Agricultural finances and Retail lending- Crop loans- Crop insurance schemes- Dairy- Sericulture- Poultry- Animal husbandry – Horticulture – Gobar gas – Kissan credit cards – NABARD initiatives – Lead bank schemes – Retail banking advances – Concept – Retail banking products – Consumer credit financing

Unit 6: (12 Hours)

NPA management – Introduction- Identification of NPAs- Asset classification- Prudential norms- Capital adequacy – International Banking Regulation-Basel Norms – asset classification provisioning – effect of NPA on profitability - Assessment procedure- Pre-sanction appraisal – Post sanction supervision- Monitoring systems for existing and likely NPAs—Tools to manage NPAs –Compromise scheme, LokAdalats, Debt Recovery Tribunals, Corporate Debt Restructuring, Willful defaulters, SARFAESI Act, Asset Reconstruction Companies-CIBIL

Practical Components:

- Students can visit a bank and study the lending and loan appraisal system relating to Agricultural loan, consumer financing etc.
- Students can study the NPA status of leading two PSU banks and two private banks.
- Students can study and submit a report on different retail banking products

RECOMMENDED BOOKS:

- Strategic Credit Management in Banks, Popli.G.S. and Puri S. K. , PHI, 2013
- Banking Theory and Practice - Shekar and Shekar, 19th Edition, Vikas Publishing House, 2009.
- Bank Management - W. Koch Scott, Timothy, Cengage Learning, New Delhi.
- Commercial Banking -Benton Gup & James Kolari, 3rd Edition, Wiley India, 2010.
- Indian Financial System, Bharati V. Pathak, 3rd Edition, Pearson, 2012.
- Bank Credit Management, G. Vijayaragavan, Himalaya Publishing House, 2009.

REFERENCE BOOKS:

- Industrial Finance - Vishwanathan R, Macmillan, New Delhi.
- Banking and Financial System - Prasad K, Nirmala and Chandradas. Himalaya Publishing House, Mumbai.
- Managing Banking Risks - Cade, Eddic, Woodhead Publishers, England.

SEMESTER III Human Resource Management Specialisation

INDUSTRIAL RELATIONS AND LEGISLATIONS

Subject Code	: 16MBA HR301	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To enable students to understand and apply the principles of IR and develop an awareness of the significance of industrial peace.
- To provide a conceptual basis of Industrial Relations.
- To give an understanding of the components and meaning of sustaining Industrial peace anchored on harmonious Employee-Management relations.
- To discuss the various Industrial acts.

Course Outcomes:

The students should be able to

- Gain the insights of IR practices in the industry.
- Develop the knowledge related to employee-management relations
- Implementation of various industrial acts

PART A:

INDUSTRIAL RELATIONS **(32 hours)**

Unit 1 **(8 hours)**

Introduction:

Background of Industrial Relations – Definition, scope, objectives, factors affecting IR, participants of IR, importance of IR. Approaches to Industrial relations, system of IR in India –Historical perspective & post-independence period, Code of Discipline and historical initiatives for harmonious IR, Government policies relating to labor, ILO and its influence on Legal enactments in India.

Unit 2 **(8 Hours)**

Collective Bargaining & Negotiation:

Collective Bargaining: Definition, Meaning, Nature, essential conditions for the success of collective bargaining, functions of collective bargaining, importance of Collective Bargaining, collective bargaining process, prerequisites for collective bargaining, implementation and administration of agreements.

Negotiations-Types of Negotiations-Problem solving attitude, Techniques of negotiation, negotiation process, essential skills for negotiation, Workers Participation in Management

Unit 3 (8 Hours)

Trade Union

Trade Unions: Meaning, trade union movement in India, Objective, role and functions of the Trade Unions in Modern Industrial Society of India, Procedure for registration of Trade Unions, Grounds for the withdrawal and cancellation of registration, union structure, Rights and responsibilities of TUs, Problems of trade unions, Employee relations in IT sector

Unit 5 (8 Hours)

Grievance procedure and Discipline management:

Grievance - Meaning and forms, sources of grievance, approaches to grievance machinery, Grievance procedures, model grievance procedure. Disciplinary procedures, approaches to manage discipline in Industry, Principles of Hot stove rule.

RECOMMENDED BOOKS:

- Employee Relations Management, P N Singh, Singh P. N., - Pearson Publications, 2011.
- Dynamics of Industrial Relations, Mamoria&Mamoria, Himalaya Publications, 2012
- Human Resource Management Principles & Practice, Aquinas, Vikas Publication.
- Personnel Management & Industrial Relations, Nair N G, Nair L, S. Chand Limited, 2001
- Essentials of Human Resource Management and Industrial Relations, Subba Rao, 3rd Revised edition, Himalaya Publishing House, 2010.

REFERENCE BOOKS:

- Industrial Relations, Trade Unions & Labour Legislation, P R N Sinha et al, Pearson Education, 2004.
- Bare Acts
 - Industrial Relations and labor laws, ArunMonappa, RanjeetNambudiri, PatturajuSelvaraj, TMH, 1997.
 - Industrial relations, trade unions and labor legislations, P R N Sinha, InduBala Sinha, Seema PriyadarshiniShekar, Pearson Education, 2013, ISBN: 9788131731642

PART B: (24 Hours)

Unit 5

INDUSTRIAL LEGISLATIONS (16 hours)

Only basic objectives and major provisions of the following legislations:

- Factories Act 1948,
- Industrial Employment (Standing orders) Act, 1946
- Employees' State Insurance (ESI) Act, 1948,
- Maternity Benefit Act, 1961
- Contract Labour Act,
- Shops and Establishments Act
- Child Labour (Prohibition & Regulation) Act, 1986
- Industrial disputes act of 1947

Unit 6 (8 Hours)

- Minimum Wages Act, 1948
- Payment of Wages Act, 1936

- Payment of Gratuity Act 1972,
- Employees' Provident Fund and Miscellaneous Provisions Act 1952;
- Payment of Bonus Act, 1965.
- Employees Compensation Act in 2013

NO PRACTICAL COMPONENT

RECOMMENDED BOOKS:

- Labor Laws for Managers, BD Singh, Excel Books, 2009
- Industrial Relations and Labor laws, SC Srivatava, 5th Edition, Vikas Publications.
- Elements of Mercantile Law - N. D Kapoor, Sultan Chand, 2004.
- Industrial Relations and Labour Legislations, Piyali Ghosh & Shefali Nandan, TMH.
- Labor Industrial Laws, Dr. V. G. Goswami, Eighth Edition, Central Law Agency, Allahabad

REFERENCE BOOKS:

- Industrial Relations, Trade Unions & Labour Legislation, P R N Sinha et al, Pearson Education, 2004.
- Bare Acts
- Industrial Relations and labor laws, Arun Monappa, Ranjeet Nambudiri, Patturaju Selvaraj, TMH, 1997.
- Industrial relations, trade unions and labor legislations, P R N Sinha, Indu Bala Sinha, Seema Priyadarshini Shekar, Pearson Education, 2013.

RECRUITMENT & SELECTION

Subject Code	: 16MBA HR302	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Course Objectives:

To understand and apply the policies and procedures of recruitment

- To provide a conceptual framework of Selection Procedure in the Industry.
- To understand the new concepts and techniques of recruitment and Selection in the Corporate.

Course Outcomes:

The students should be able to

- Learn the various recruitment policies and procedures.
- Equip with conceptual framework of selection procedures.
- Gain insights of the latest concepts and techniques used in recruitment and selection.

Unit 1:

(6 Hours)

Job Analysis: Meaning, definition and purpose. Methods of job analysis: job analysis interviews, job analysis questionnaire, task analysis inventory, position analysis questionnaire, subject expert

workshops, critical incident technique, Fleishman job analysis survey, functional job analysis, job element method, repertory grid, critical incident technique

Unit 2: (9 Hours)

Hiring Process & Hiring decision: Nature of hiring: regular, temporary, full time, part time, apprentice, contractual, and outsourcing, Existing post or new post to be created, Need analysis, cost analysis and job analysis.

Unit 3: (7 Hours)

Hiring internally: Meaning and definition of internal recruitment, Advantages and disadvantages in terms of cost, time, quality and suitability. Sources of internal recruitment: - circulars, intranet advertisements, employee referrals, Appointment or promotion, Policy guidelines and union settlements.

Unit 4: (10 Hours)

External Hiring: Meaning and definition of external recruitment. Sources of recruitment:- advertisement, in newspaper, TV/Radio, Internet, search on the internet, wanted signboards, consultants, employment exchange, campus recruitment, employee referrals and unsolicited applications. Advantages and disadvantages of the above sources in terms of cost, time, convenience, reach of the targeted population, and quality of applicant pool.

Job advertisement: drafting, size and contents. Contents of public sector recruitment: single or multiple sources and choosing the best source

Unit 5: (8 Hours)

Screening the candidates: Application Forms: bio-data / resume / curriculum vitae and Weighted application blanks: meaning definition, purpose, advantages and disadvantages – taking a Behavioral approach to recruitment: spotting personality patterns, making basic assumptions, Predicting the future, strategy Vs. Technique, Pinning down what is needed: targeted interviewing, focusing on behavior, assessing how person performs, assuming they have been hired. – Identifying the ingredients of success: the winning candidate's profile, challenges in the Interview, the starting point, day to day execution, dealing with people, the inner person, additional characteristics. Studying the CV.

Unit 6: (16 Hours)

Testing, Reference checking & Appointment orders: Meaning, definition, purpose, advantages and disadvantages, Ability tests clerical ability test, mechanical ability test, mental ability test, physical ability test, personality assessment test, typing test, shorthand test, computer proficiency test

Interviewing: Planning the interview, Interview process - Interview in public sector undertaking. Statutory requirements.

Reference checking: meaning, definition and purpose. Verification of character, criminal antecedents, previous work behavior and education qualifications. Verification of community certificates in public sector companies.

Appointment orders: Meaning, definition, and purpose. Contents of appointment letter, hard copy (or soft copy),

Practical Components:

- Students need to identify two jobs in the college and need to do job analysis for those positions using any of the job analysis methods.

- In teams students can be asked to give presentations about various types of jobs (regular, temporary, full time, part time, apprentice, contractual, and outsourcing) in different industries along with its advantages and disadvantages
- In Teams, select and analyze any two of the Job postings advertisements in Newspapers to know more about job description and job specification mentioned in each advertisement for every post.
- Obtain online access to the resume data base of Naukri.com or Monsterindia.com for a week give at least four Job Descriptions and specification to each student, to search and download from the data base at least five resumes for each positions.
- Students can identify 4 or 5 jobs of their interest and can create Advertisements for the same imagining that they are Proprietors of the companies and hiring for these positions.
- Debate on Advantages and disadvantages of hiring external and Internal for the selected jobs like
- Police Constable, Doctor, CEO, Mechanical Engineer, Professor etc.,
- Role play: Students can do the role play for the entire process of hiring and selecting 3 or 4 selected roles in a specific industry.

RECOMMENDED BOOKS:

- Human Resource Selection, Robert D. Gatewood and Hubert S. I, South western Cengage Learning, Mason, Ohio, 2001.
- Recruitment and Selection -Theory and Practice. Dipak kumar Bhattacharya Cengage Learning.
- Staffing Organization, Herbert G. Heneman III, Timothy A. Judge, 5th Edition, McGraw Hill International.
- Recruitment and Selection, Elearn, Revised Edition, Routledge, 2009.
- Online Recruiting and Selection: Innovations in Talent Acquisition, Douglas H. Reynolds, John A. Weiner, John Wiley & Sons, 2009.
- Effective Recruitment and Selection Practices, R. L. Compton, William J. Morrissey, Alan R. Nankervis, Bill Morrissey, CCH Australia Limited, 2009.

REFERENCE BOOKS:

- Employee Selection, Lilly M Berry, 1 edition, Cengage Learning, 2002.
- Hiring & keeping the best people, HBS Press, 2013, ISBN: 1422131785, 9781422131787
- Human Resource Planning, Dipak Kumar Bhattacharyya, 2nd edition, Excel Books, 2009, ISBN: 8174464980, 9788174464989
- High performance hiring by Robert W. Wendover, Crisp Publication, California, 1991.

COMPENSATION AND BENEFITS

Subject Code	: 16MBA HR303	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives

- To know the theoretical and practical developments in the area of compensation and benefits.
- To discuss the strategic importance of compensation for the achievement of organizational goals.

- To understand the relationship between compensation objectives and business strategy.
- To discuss the role of compensation in attracting, motivating, and retaining a high-quality workforce.

Course Outcomes:

The students will be able to

- Gain insights of various conceptual aspects of Compensation and Benefits.
- Determine the performance based compensation system for business excellence.
- Understand the Legal & Administrative Issues in Compensation Global Compensation

Unit 1: (7 Hours)

Introduction to Compensation: Definition of Compensation, Basic concepts of Compensation (wages, salary, benefits, DA, consolidated pay, Equity based programs, commission, reward, remuneration, bonus etc.), Types of Compensation Management - The Pay Model, Strategic Pay Policies, Strategic Perspectives of Pay, Strategic Pay Decisions, Best Practices vs. Best Fit Options

Unit 2: (5 Hours)

Internal Alignment: Definition of Internal Alignment, Internal Pay Structures, Strategic Choices In Internal Alignment Design, Internal Structure

Unit 3: (7Hours)

Job Evaluation: Definition of Job Evaluation, Major Decisions in Job Evaluation, Job Evaluation Methods, Final Result – Pay Structure- various methods of calculation of compensation: Straight Piece Rate Method, Flat Time Rate Method, Halsey Premium Bonus Plan, Rowan Premium Bonus Plan, Taylor Differential Piece Rate Method

Unit 4: (8Hours)

Determining External Competitiveness and Benefits Management:

Competitiveness: Definition of Competitiveness, Pay Policy Alternatives, Wage Surveys, Interpreting Survey Results, Pay Policy Line, Pay Grades

Benefits: Benefits Determination Process, Value of Benefits, Legally Required Benefits, Retirement, Medical, & Other Benefits

Unit 5: (9 Hours)

Performance Based Compensation System:

Employee Contributions: Pay For Performance (PFP): Rewarding Desired Behaviors, Designing PFP Plans, Merit Pay/Variable Pay, Individual vs. Group Incentives, Long Term Incentives. Compensation of Special Groups, Compensation Strategies for Special Groups

Unit 6: (20 Hours)

Legal & Administrative Issues in Compensation Global Compensation: Legal Issues, Pay Discrimination, Comparable Worth, Budgets and Administration: Recognizing Variations, Social Contract, Culture & Pay, Strategic Choices in Global Compensation, Comparing Systems, Expatriate Pay

Practical Components

- Students must prepare a comprehensive compensation plan to be offered to a Sales Executive, A General Manager and The CEO of an organization.

- Students to collect information from an IT organization regarding the Cost To Company of an employee.
- Students have to prepare questionnaire for conducting wage survey and carry out wage survey for any selected sector and prepare a report for the same.
- Solve various case studies.
- Students must compare and analyze compensation practices in different countries.
- Students to calculate the bonus amount eligible to an employee working as a HR Executive for the past 10 years in an automobile manufacturing organization.

RECOMMENDED BOOKS:

- Compensation & Reward Management, BD Singh, 2ndedition, Excel BOOKS, 2012.
- Compensation, Milkovich& Newman, 6thedition, Irwin/McGraw-Hill.
- Compensation and Benefit Design, Bashker D. Biswas, FT Press, 2012.
- An Introduction to Executive Compensation, Steven Balsam, Academic Press, 2002.

REFERENCE BOOKS:

- Strategic Compensation, Joseph J. Martocchio, 3rd Edition, Prentice Hall, 2004.
- Compensation Management in a Knowledge based world, Richard I. Anderson, 10th edition, Pearson Education
- Compensation Management, ErSoniShyam Singh, Excel Books.

LEARNING AND DEVELOPMENT

Subject Code	: 16MBA HR304	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To enable students to be aware of the field of learning and development and its role in optimizing performance.
- To make students understand the process of analyzing training needs and evaluating training programs
- To provide the students an overview of the various Training and Management Development Method

Course Outcomes:

The Students will be able to

- Understand the concepts of learning and development and its role.
- Learn various contemporary methods of learning and development.
- Gain insights of various training evaluation methods and career planning.

Unit 1:

(8 Hours)

Introduction to Employee learning and Development, learning, Meaning and significance, The Forces Influencing Working and Learning, classification of learning capabilities, learning theories- Reinforcement Theory, Social Learning Theory, Goal Theories, Expectancy Theory, Adult Learning Theory, pedagogy and andragogy; The basic principles of learning, The Learning Process , Mental and Physical Processes, The Learning Cycle, Instructional Emphasis for Learning Outcomes.

Unit 2: (6 Hours)

Training and Learning: Introduction, Relationship, meaning, Designing Effective Training, Forces influencing working & learning, Strategic Training, Work Environment, Characteristics influencing transfer of training, organizational environments encouraging transfer.

Unit 3: (7 Hours)

Training Needs Analysis: Meaning and significance of training needs, types of needs, components of needs, data collection, analysis and interpretation. Meaning and significance of training design and development, principles of training design, design process, identifying the training objectives, determining structure, content, duration, method, learning activities,

Unit 4: (11 Hours)

Training implementation & Methods: Meaning and significance of implementation, making or buying decision, implementation process for making and buying decisions, skills of effective trainer.

Training Methods: Presentation Methods, Hands-on Methods, Group Building Methods. Choosing Training methods. E-Learning & Use of Technology in Training: Technology's Influence on Training, Technology & Multimedia, Computer-Based Training, Developing Effective Online Learning, Blended Learning, Simulations, Mobile Technology & Training Methods, Intelligent Tutoring Systems, Distance Learning, Technologies for Training Support, Technologies for Training Administration, Learning Management Systems (LMSs), Systems for Training Delivery, Support & Administration, Choosing New Technology Training Methods.

Outward bound methods: Meaning and significance of outward bound learning (OBL) methods, process of OBL, risk, safety and ethical issues. Training aids.

Unit 5: (8 Hours)

Training Evaluation: Meaning, Reasons for Evaluating Training and significance of training evaluation, Donald Kirkpatrick's Evaluation Model, Return on investment in Training, Types of Evaluation Designs, Considerations in Choosing an Evaluation Design, data collection for training evaluation, Threats to Validity, Determining Costs, Evaluation Practices in different organizations, Measuring Human Capital and Training Activity

Unit 6: (16 Hours)

Executive Development/ Management Development/Career Management

Need, factors affecting MDP, methods, process, administration, delivery, costing & pricing, Company Strategies for Providing Development, Increased Use of New Technologies for Learning, Increased Demand for Learning for Virtual Work Arrangements, Increased Use of Training Partnerships & Outsourcing Training,

Careers and Career Management: Introduction, Importance, Career: meaning, A Model of Career Development (Career Stages), Career Management Systems

Practical Components:

- Study training programs and processes in different organizations and analyze their effectiveness.
- Students to design a training program for a specific job role.
- Students are expected to conduct a mock training session including need identification and a set of
- Students to evaluate the effectiveness of the same.
- Give a training needs analysis case and ask the students to find out the training needs
- Implement various training methods, observe and submit a report on its effectiveness.

RECOMMENDED BOOKS:

- Effective Training, P Nick and Blanchard, 2nd Edition, Pearson Education/PHI, 2005
- Training & Development, Dr. B. Janakiraman, Biztantra/Wiley Dreamtech, 2005
- Employee Training & Development, Noe A Raymond, 2nd edition, McGraw Hill Publication.
- Management Training and Development, Gupta B.L, 1st Edition, Vrinda Publications, 2011.
- Training and Development Methods, Dr. Rishipal, 1st Edition, S. Chand, 2011.
- Personal Growth and Training & Development, Ruchi Srivastava, 1st Edition, Vrinda Publications,
- 2011.

REFERENCE BOOKS:

- Training for development– Rolf Lynton & Udai Pareek, Sage Publications, 2011.
- Effective HR Training Development Strategy – Ratan Reddy, HPH, 2005.
- Training in organizations - Goldstein, 4th Edition, Cengage learning.

KNOWLEDGE MANAGEMENT

Subject Code	: 16MBA HR305	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the fundamental concepts of Knowledge management.
- To discuss the current trends in knowledge management and their manifestation in business
- To analyze and build communities of practice to contribute and share knowledge

Course Outcomes:

The students will be able to

- Gain insights about the concepts of knowledge management.
- Enable with the architecture and models of knowledge management
- Learn knowledge management lifecycle and dissemination

Unit 1:

(9 hours)

Understanding knowledge: the core of business: What Is Knowledge Management, Multidisciplinary Nature of KM, Drivers of KM, The Two Major Types of Knowledge, The Concept Analysis Technique, History of Knowledge Management, From Physical Assets to Knowledge Assets, Organizational Perspectives on Knowledge Management, Knowledge, Intelligence,

Experience, Common sense. Cognition and KM. Types of Knowledge, Knowledge Management architecture and Implementation Strategies.

Knowledge creation and capture: Knowledge Creation, Nonaka's Model, Major Theoretical KM Models, Takeuchi Knowledge Spiral Model, Knowledge Conversion.

Unit 2: (7 hours)

The knowledge management cycle: Knowledge Management System Life Cycle, Major Approaches to the KM Cycle, The Zack KM Cycle, The Bukowitz and Williams KM Cycle.

Unit 3: (6 hours)

Knowledge sharing and communities of practice: The Social Nature of Knowledge, Sharing Communities, Types of Communities, Roles and Responsibilities in CoPs, Knowledge Sharing in Virtual CoPs, Data Mining and Knowledge Discovery, Blogs, Content Management Tools, Knowledge Sharing and Dissemination Tools.

Unit 4: (12 hours)

Knowledge application: KM for Individuals, Communities and Organizations, Future Challenges for KM. Knowledge Application at the Individual, Group & Organizational Levels, Characteristics of Individual Knowledge Workers, Task Analysis and Modelling, EPSS, Knowledge Reuse, Knowledge Repositories, Strategic & Practical Implications of Knowledge Application

The role of organizational culture: Different Types of Cultures, Organizational Culture Analysis, Culture at the Foundation of KM, The Effects of Culture on Individuals, Cultural Transformation to a Knowledge-Sharing Culture, Organizational Maturity Models, KM Maturity Models, CoP Maturity Models,

Unit 5: (12 hours)

KM strategy and metrics: Knowledge Management Strategy, Knowledge Audit, Gap Analysis, The KM Strategy Road Map, The Management of Organizational Memory, Balancing Innovation and Organizational Structure, Historical Overview of Metrics in KM, KM Metrics, The Benchmarking Method, The Balanced Scorecard Method.

Unit 6: (10 hours)

The KM team & learning organizations: learning organization: The mystique of learning organization, learning and change, RICE Model. Major Categories of KM Roles, Senior Management Roles, KM Roles and Responsibilities within Organizations, the KM Profession. Ethical, legal and managerial issues.

Practical Components:

- To expose and make students to prepare a report on knowledge management practices implemented by successful companies.
- Make a team of 2-3 students and asking them to conduct a telephonic interview or survey regarding local businesses familiarity with and level of literacy in KM.
- To do a comparison on the KM Life Cycle Models and seeing their applicability in organizations.
- To organize a group discussion for students and enable them to go through the knowledge acquisition phases.

- Asking students to compare and contrast on different COPs.

RECOMMENDED BOOKS:

- Knowledge Management, Elias M Awad, Hassan M Ghaziri, PHI, 3rd Edition.
- Knowledge Management in Theory and Practice, KimizDalkir, 2nd Edition, PHI.
- Knowledge Management: Tool for Business Development, Dr. B. Rathana Reddy, Himalaya Publishing House.
- Knowledge Management, Sudhir Warier, Vikas Publishing House.

REFERENCE BOOKS:

- Knowledge Management, RatnajaGogula, ICFAI University Press, 2002.
- Handbook on knowledge management, Holsapple, Springer Verlag, 2003.
- Knowledge Management: Systems and Processes, Fernandez Irma Becerra, Sabherwal Rajiv, Prentice Hall India.

CONFLICT AND NEGOTIATION MANAGEMENT

Subject Code	: 16MBA HR306	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the nature of various dimensions of conflict
- To learn various strategies and techniques to manage conflicts
- To understand the importance and role of negotiation in conflict resolution
- To understand the importance of cross-cultural and gender dimensions of negotiation

Course Outcomes:

The students will be able to

- Gain insights of various dimensions of conflicts in an organization
- Know the various strategies and techniques of managing conflicts.
- Learn the process of negotiation and its relevance in conflict resolution.

Unit 1:

(8 Hours)

Introduction: Understanding conflict, components, perspectives of conflict, types of conflict, models of conflict – Process and Structural Models, functional & dysfunctional conflict, relationship between conflict and performance in team, levels of conflict – intrapersonal, interpersonal, group &

organizational conflicts, sources of conflict - intrapersonal, interpersonal, group & organizational sources.

Unit2: (8 Hours)

Conflict Management Design: Nature of conflict Management, contingency approach, conflict management process, the conflict domain, conflict trends, conflict distribution, conflict mapping and tracking.

Unit 3: (10Hours)

Managing Conflict: Managing interpersonal conflict: Thomas conflict resolution approach, behavioral style and conflict handling, the CosierSchank model of conflict resolution, collaboration & conflict resolution, dealing with difficult subordinates, boss & colleagues, 1 to 1 dispute resolution.

Managing team & organization conflict: techniques to resolve team conflict, strategies to resolve organizational conflict, effective listening and dialogue skills, humor and conflict resolution, negotiation as a tool for conflict resolution.

Unit 4: (8 Hours)

Conflict resolution and Cost: Conflict resolution models, framework model, classical ideas, new developments in conflict resolution. Environmental conflict resolution, gender and conflict resolution. Assessing the cost of workplace conflict.

Unit 5: (14 Hours)

Negotiations/Negotiation strategies -Types of Negotiations, negotiation process, factors for successful negotiations, essential skills for negotiation, tricks used in negotiation process, psychological advantage of negotiations, Techniques of negotiation, issues in negotiations.

Negotiation strategies: Strategy and tactics for distributive bargaining, strategy and tactics for integrative negotiation, negotiation strategy and planning. Finding and using negotiation power, sources of power, Ethics in negotiation.

Unit 6: (8Hours)

Managing difficult negotiations: Third party approaches: Third party interventions, formal intervention methods – Arbitration, Mediation and Process Consultation, Informal intervention methods, best practices in negotiation.

Practical Components

- Survey the conflict resolution techniques adopted by individuals based on individual personality types.
- Dividing students into groups and give a scenario to negotiate and reach conclusion.
- Reading: 8 Habits of Highly Effective People; apply the concepts to understand how people approach negotiation through different mind – sets.
- Conduct Role Plays for different scenarios.
- Solve various case studies dealing with conflict between teams and organizations.

- Ask students to identify three unconscious factors that may affect their negotiation effectiveness and ask them to explain why or how that phenomenon may occur.
- Management games like two dollar game, cross the line games can be played in the class to develop negotiation skills among the students.

RECOMMENDED BOOKS:

- Corporate Conflict Management - Concepts and Skills, Eirene Leela Rout, Nelson Omiko, Prentice India, 2007.
- Negotiations, Roy J. Lewicki, David M. Saunders, Bruce Barry, 5/e, Mc Graw Hill, 2005
- Contemporary Conflict Resolution, Oliver Ramsbotham, Hugh Miall, Tom Woodhouse, 3rd edition, Polity publishers, 2011.
- Handling Conflict and Negotiation, Manchester Open Learning, illustrated edition, Kogan Page, 1993.

REFERENCE BOOKS:

- Managing conflict and negotiation, B.D. Singh, 1st edition, Excel books, 2008.
- Conflict Management: Practical guide to develop negotiation strategies, Barbara A Budjac Corvette, Pearson Prentice Hall, 2006.
- Managing Conflict in Organizations, M. Afzalur Rahim, 4th Edition, Transaction Publishers, 2011.

SEMESTER IV MARKETING SPECIALISATION SALES MANAGEMENT

Subject Code	: 16MBA MM401	IA Marks : 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To provide an understanding of the concepts, techniques and approaches in Sales Management.
- To emphasize on the Sales Manager's problems and dilemmas.
- To develop skills for generating, evaluating and selecting sales strategies.

Outcomes:

The student should be able to:

- Know the distinction between the skills required for selling and sales management.
- Develop a plan for organizing, staffing and training the sales force.
- Organize sales territories to maximize selling effectiveness.

- Evaluate sales management strategies

Unit 1: (8 hours)

Introduction to sales management: Meaning, Evaluation, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. Types of sales organizations.

Unit 2: (8 hours)

Selling skills & Selling strategies: Selling and business Styles, selling skills, situations, selling process, sales presentation, Handling customer objections, Follow-up action.

Unit 3: (8 hours)

Management of Sales Territory & Sales Quota: Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota. Recruitment and selection of sales force, Training of sales force.

Unit 4: (10 hours)

Sales force motivation and compensation: Nature of motivation, Importance, Process and factors in the motivation, Compensation-Meaning, Types of compensation plans and evaluation of sales force by performance and appraisal process. **Sales management job:** Standard sales management process-international sales management -international market selection-market survey approach or strategy

Unit 5: (8 hours)

Sales Manager and Sales Person: Role of sales manager and sales people; functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people-Time management for sales manager and sales person.

Unit 6 (8 hours)

Selling on the internet: Selling agents for internet trading-net selling, advertising in net trading, payment system in internet trading-smart card, credit card, debit card- payment by card: advantages and disadvantages; How to make internet selling safe-Digital signature, biometric method and legal or regulatory environment; Growth of internet trading in India.

Case Studies in Sales Management (6 hours)

Practical component:

- Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why chose sales career, and what does it take to succeed in this profession
- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products

into low risk and high risk ones. Does this buying behaviour also depend on the personality of the individual doing the buying? Or the one doing the selling?

- Students can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where the institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.
- Roles and functions of sales manager and sales people are different in every organization. Sales people view the roles of sales managers in their own way and vice versa. You are the sales manager of a company. You make an analysis of what you feel should be roles of a sales manager and a salesperson for maximizing sales of the organization.
- Your company is active in internet trading. A current issue in internet trading is : how to make internet selling safe. Different methods have been suggested for safety or security of internet trading. You have to analyze different methods and recommend a method for your company.

RECOMMENDED BOOKS:

- Sales Management by Charles, Futrell, 6/e, Thomson South Western, 2003.
- Sales & Distribution Management, Tapan K. Panda & Sunil Sahadev, 6/e, Oxford University Press.
- Sales & Distribution Management, A. Nag, McGraw Hill, 2013

REFERENCE BOOKS:

- Managing of Sales Force by Spiro Stanton Rich, 11/e, TMH, 2003.
- Sales & Retail Management, an Indian perspective by Dr. S.L. Gupta, 1/e, Excel Books, 2007.
- Salesmanship and Sales Management-P.K. Sahu & K. C. Raut, 3/e, Vikas Publishing House.
- Sales Management-Douglas J Dalrymple, William L Crowe-John Wiley & Co.
- Sales & Distribution Management- Text and Cases, 2nd Ed, McGraw Hill.

INTEGRATED MARKETING COMMUNICATIONS

Subject Code	: 16MBA MM402	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives:

- To build a comprehensive framework for integrated marketing communications.
- To study the advertising, publicity, personal selling, direct marketing and sales promotion.
- To enhance knowledge of emerging trends in integrated marketing communications.

Outcomes:

The student should be able to:

- Define and apply knowledge of various aspects of managerial decision making related to marketing communications strategy and tactics.
- Ability to create an integrated marketing communications plan which includes promotional strategies.
- Explain the role of IMC in the overall marketing & Use effectiveness measures to evaluate IMC strategies

Unit 1:

(10 Hours)

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model. Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications Purpose, Role, Functions, Types, Advertising Vs Marketing mix, Advertising appeal in various stages of PLC

Unit 2:

(8 Hours)

Advertising Agency: Type of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation.

Advertising objectives and Budgeting: Goal setting – DAGMAR approach, various budgeting methods used.

Unit 3:

(8 Hours)

Media planning: Developing Media plan, Problems encountered, Media Evaluation- Print, Broadcast media, Support media in advertising.

Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy.

Unit 4:

(8 Hours)

Direct Marketing: Features, Functions, Growth, Advantages/Disadvantages, And Direct Marketing Strategies.

Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push/pull strategies, Co-operative advertising, Integration with advertising and publicity

Public relation/ Publicity:- Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR Vs Publicity.

Unit 5:

(8 Hours)

Monitoring, Evaluation and control: Measurement in advertising, various methods used for evaluation, Pre-testing, Post testing.

Unit 6:

(10 Hours)

International Advertising: Global environment in advertising, Decision areas in international advertising

Internet advertising: Meaning, Components, Advantages and Limitations, Types of Internet advertising

Industrial advertising: B 2 B Communication, Special issues in Industrial selling.

Case studies in Indian context only

(4 Hours)

Practical Components:

- Study the IMC programs adopted by various colleges to students applying for an MBA course? Is the tactic adopted by your college right? If no, what are your suggestions?
- Study the role of newspapers, radio, television, billboards, internet and other media in the marketing of mobiles, cold drinks, jeans, mobiles etc.
- Observe a marriage in your family and write about how you would 'event manage' it?
- Take an advertisement introducing a new product like soap, biscuit etc and find the media in which it was advertised. Ask your friends if they can recall this advertisement and the message. Analyse if they would or would not buy the product on the basis of this advertisement? And why?
- Students can do a survey on effective media communications.

RECOMMENDED BOOKS:

- Advertising and Promotions IMC Perspectives: Belch and Belch, 9/e, Tata McGraw Hill, 2012.
- Advertising & Integrated Brand Promotion - O'Guinn, Allen, Semenik, Cengage Learning.
- Integrated Advertising, Promotion, and Marketing Communications, Clow, Baack, 3/e, Pearson Education, 2007.
- Integrated Marketing Communications – Niraj Kumar, HPH.

REFERENCE BOOKS:

- Foundations of Advertising, Chynawalla & Sethia, HPH, 2007
- Advertising management - Rajeev Batra, John G Myers & Aaker, 5/e, PHI, 2007.
- Event marketing and management- Sanjaya Singh, Vikas Publication, 2003.
- Advertising Basics, Vilanilam, Varghese, Response BOOKS, 2007
- Advertising, Sangeeta Sharma & Raghuvir Singh, PHI, 2006.

E-MARKETING

Subject Code	: 16MBA MM403	IA Marks : 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To understand the important concepts related to e-marketing
- To learn the use of different electronic media for designing marketing activities.
- To acquaint the students with the latest techniques of e-marketing.

Objectives:

The student should be able to:

- Recognize appropriate e-marketing objectives.
- Appreciate the e-commerce framework and technology.
- Illustrate the use of search engine marketing, online advertising and marketing strategies.

Unit 1: (10 Hours)

Introduction to E-Marketing: Landscape – Past – Today – Future – Internet Marketing Paradigm – Internet Infrastructure Stack

Business Models & Strategies: Strategic Planning – Strategy to Electronic Planning – Strategic Drivers of the Internet Economy – Business Models to E-Business Models – E-Business Models – Performance Metrics – The Balanced Scorecard

Unit 2: (12 Hours)

E-Marketing Plan: Overview of the E-Marketing Planning Process – Creating an E-Marketing Plan – A Seven-Step E-Marketing Plan

The E-Marketing Environment: Overview of Global E-Marketing Issues – Country and Market Opportunity Analysis – Technological Readiness Influences Marketing – Wireless Internet Access – The Digital Divide Ethical and Legal Issues – Privacy – Digital Property – Online Expression – Cyber Security – Cyber Crime

Unit 3: (8 Hours)

E-Marketing Research: Data Drive Strategy – Marketing Knowledge Management – Monitoring Social Media – Technology-Enabled Approaches – Real-Space Approaches – Marketing Databases and Data Warehouses – Data Analysis and Distribution – Knowledge Management Metrics – Consumer Behaviour Online – Segmentation – Targeting – Differentiation – Positioning Strategies

Unit 4: (10 Hours)

E-Marketing Management: Product – Products on Internet – Creating Customer Value Online – Product Benefits – E-Marketing Enhanced Product Development – Price – Change in Pricing Strategies – Buyer and Seller Perspectives – Payment Options – Pricing Strategies – Distribution – Online Channel Intermediaries – Distribution Channel Length and Functions – Channel Management and Power – Distribution Channel Metrics – Promotion – Integrated Marketing Communication (IMC) – Internet Advertising – Marketing Public Relations – Sales Promotion Offers – Direct Marketing – Personal Selling – IMC Metrics

Unit 5: (8 Hours)

Customer Acquisition and Retention: Profile of Consumers – Browsing Behaviour Model – Elements of Social Media – Social Media Strategies – Social Media Performance Metrics – Building Customer Relationships – Relationship Marketing – Stakeholders – Three Pillars of Relationship Marketing – Customer Relationship Management (CRM) – CRM Building Blocks – Ten rules for CRM Success

Unit 6: (8 Hours)

Evaluating Performance and Opportunities: Measuring and evaluating web marketing programs – Social and Regulatory Issues – Privacy – Security – Intellectual Property – Mobile Marketing – Media Coverage

Emerging Issues: Online Governance and ICANN – Jurisdiction – Fraud – Consumer Loyalty of Website-Services – The Quadratic Effect of Flow – Role of Technology Readiness in Developing Trust and Loyalty for E-Services in Developing Countries

Practical Component:

- Students can form a team and identify Internet Properties & its Marketing Implication
- Students can choose a Website for analysis based on its content, design, usability, attractiveness and other website properties
- Students can conduct a survey on Consumer who use internet marketing to identify the pros and cons of e-marketing.
- Students can do a project on branding strategies using internet marketing.
- Students can write a report on Google advertising strategies
- Students can discuss about traditional offline business in the online world.

RECOMMENDED BOOKS:

- E-Marketing, Judy Strauss and Raymond Frost, Prentice Hall, 6th Edition, 2013
- Internet Marketing: Integrating Online and Offline Strategies. M. L. Roberts and Debra Zahay, 3rd edition, Cengage Publishing, 2013
- Digital Marketing: Strategy, Implementation and Practice, Chaffey D., Ellis-Chadwick, 5th Edition, F., Pearson, 2012.
- E Marketing – The essential guide to online marketing, Rob Stokes, Flat worldknowledge, 2010.
- E-marketing in Developed and Developing Countries: Emerging Practices, Hatem El-Gohary and Riyadh Eid, IGI Global, 2013

REFERENCE BOOKS:

- The Essential Guide to Online Marketing, Rob Stokes, Quirk, ISBN: 9781936126323
- The New Rules of Marketing and PR: How to Use Social Media, Blogs, News Releases, Online Video, and Viral Marketing to Reach Buyers Directly, David Meerman Scott, 2nd Edition, Jan 2010
- E-Commerce: An Indian Perspective, P. T. Joseph, Prentice Hall, 4th Edition, 2013
- Electronic Commerce: A Simplified Approach, Munesh Chandra Trivedi, JaicoPublishing House, 2011.
- Online Display Advertising: Targeting and Obtrusiveness, Marketing Science, Goldfarband Tucker, May-June 2011.

STRATEGIC BRAND MANAGEMENT

Subject Code	: 16MBA MM404	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To appreciate the relationship between corporate strategy and Brand Management.

- To explore the various issues related to Brand Management, brand association, brand identity, brand architecture, leveraging brand assets, brand portfolio management.
- To develop familiarity and competence with the strategies and tactics involved in building, leveraging and defending strong brands in different sectors.

Outcomes:

The student should be able to:

- Develop skills for managing brands strategically.
- Compare and contrast the elements of product and brand management.
- Assess growth-opportunities for brands, e.g., brand extension strategies
- Critique the different measures of brand equity.

Unit 1: (8 Hours)

Introduction to the concept of Brand Management:

Brand –Meaning, Definition, Evolution of Brands, Functions of Brand to consumer, Role of Brand- Advantages of Brand, Product Vs Brand,

Branding- Meaning, Creation of Brands through goods, services, people, Organisation, Retailstores, places, online, entertainment, ideas, challenges to Brand builders

Brand Management-Meaning & Definition.

Strategic Brand Management Process-Meaning, Steps in Brand Management Process Strong Indian Brands

Unit 2: (8 Hours)

Customer Based Brand Equity:

Customer Based Brand Equity-Meaning, Model of CBBE

Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks-Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, David Aaker's Brand Equity Model.

Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism,

Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines

Brand Value: Definition, Core Brand values, Brand mantras, Internal branding,

Unit 3: (10 Hours)

Choosing Brand Elements to Build Brand Equity:

Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging.

Leveraging Brand Knowledge:

Meaning of Brand Knowledge, Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process.

Unit 4: (10 Hours)

Brand Value chain- Designing Brand Tracking studies, Establishing brand Equity Management Systems.

Methods for measuring Brand Equity- Quantitative Techniques & Quantitative Techniques, Comparative methods-Brand based comparisons, marketing based comparisons-Conjoint Analysis, Holistic methods.

Managing Brand Equity: Brand Reinforcement, Brand Revitalization, Brand Crisis.

Unit 5: (8 Hours)

Designing and sustaining branding strategies: Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation.

Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.

Unit 6: (8 Hours)

Making Brands go Global: Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization, managerial blockages, organization for a global brand, pathways to globalization.

Luxury Brand Management:

Luxury definition and relativity, luxury goods and luxury brands, basic psychological phenomena associated with luxury purchase, luxury marketing mix, luxury retail, International luxury markets: historical leaders and emerging countries.

Case studies (4 Hours)

Practical Components:

- Go to a supermarket and find the brand elements in various brands of soaps, mobiles, jeans, and other product
- If you would start an MBA College, what would the positioning be with POP's and POD's?
- Pick up your college, analyse its positioning and how would you reposition it?
- Pick a multiproduct company and as completely as possible analyze its brand portfolio and brand extensions?
- Consider some groups like Tata's, Birla's, Infosys etc – what is their branding strategy
- Students are supposed to assess the product life cycle and appraise alternative approaches to luxury brand management.
- Students can select any two popular brands and identify and examine the criteria for success in the luxury brand industry.

RECOMMENDED BOOKS:

- Strategic Brand Management, Building Measuring & Managing Brand Equity – 2nd Ed Phi / Pearson Education – Kevin Lane Keller.
- Brand Management -The Indian Context – Y L R Moorthi – Vikas Publication.
- Strategic Brand Management – Jean, Noel, Kapferer – Kogan Page India.
- Brand Imitations – Dr S Kaplan, Dr S Pandey, 1/e, HPH, 2004.
- Brand Management, Tapan Panda, 2/e, Excel Publication.

REFERENCE BOOKS:

- Brand Management- Harish V Verma, 2/e, Excel BOOKS.
- Compendium Brand Management – Chunnawalla, 1/e, HPH, 2003.
- Managing Indian Brands – S Ramesh Kumar – Vikas.
- Strategic Brand Management- Richard Elliott & Larry Perclu, 1/e, Oxford Press.
- Creating powerful brands – Chernatony, 1/e, Elsevier Publication.

RURAL MARKETING

Subject Code	: 16MBA MM405	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To provide a conceptual understanding on the RuralMarketing with special reference to Indian context.
- To create awareness about the applicability of the concepts, techniques and processes ofmarketing in rural context.
- To familiarize with the special problems related to sales in rural markets.

Outcomes:

The student should be able to:

- Highlight the characteristics of Indian rural markets and describe the differences between rural and the urban economy
- Analyze the roadblocks of Indian rural market and advocate solutions for the problems of rural markets.
- Emphasize the different strategies adopted by Indian companies for rural markets.
- Apply the strategies to be adopted for influencing the rural consumers.

Unit 1:

(8 Hours)

Introduction to Indian Rural Marketing: Definition, scope of rural marketing, concepts, classification of rural markets, rural vs. urban markets. Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, rural credit institutions, rural retail outlets, print media in rural areas,rural areas requirement, rural demand and rural market index, problems in rural marketing.

Unit 2:

(8 Hours)

Rural Consumer behaviour: Consumer buying behaviour models, Factors affecting ConsumerBehaviour, Social factors, Technological Factors, Economic Factors, Political Factors,Characteristics of Rural consumer- Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and prepurchase Evaluation, Rise of Consumerism, Consumer Buying Process, Opinion LeadershipProcess, Diffusion of Innovation, Brand Loyalty.

Researching Rural Market: Sensitizing rural market, Research design- reference frame, Research approach, Diffusion of innovation, Development studies, PRA approach, The need for PRA, Sampling, Operational aspects of data collection,

Unit 3: (8 Hours)

Rural Marketing of FMCG's: Indian FMCG industry, characteristics of Indian FMCG sector, Challenges in the FMCG industry, Rural Marketing of FMCG's: Select case studies

Rural Marketing of Consumer durables: Issues related to consumer durables in the rural market, Rural Marketing of Consumer durables: Select case studies

Rural marketing of financial services: Marketing objectives and approaches, Evolution of rural banking after independence, Challenges in marketing for banking services in rural, opportunities for banking in rural areas, marketing strategies for banking services

Unit 4: (10 Hours)

Marketing of agricultural inputs: Indian tractor industry: A brief overview, Challenges for Indian tractor industry, factors suggesting better future prospects for tractor industry, marketing strategies for tractor industry

Fertilizer industry in India: Marketing of fertilizer industry, classification of fertilizer industry, Challenges for marketing of fertilizer industry, marketing strategies for fertilizer industry.

Indian agrochemical market: Marketing environment for agrochemicals in India, factors affecting agro chemicals market growth, structural challenges faced by Indian agrochemical industry, marketing strategies for agro chemicals.

Unit 5: (8 Hours)

Marketing of agricultural produce: Profiling of Indian agricultural produces marketing, challenges in marketing of agricultural produce, Strategies to promote marketing of agricultural produce

Marketing of rural artisan products, Characteristics of Indian handicrafts industry, Challenges for rural artisan sector, Government policy towards handicrafts sector, marketing strategies for the development of rural artisan sector

Corporate sector in agri-business: Reasons for increased interest of corporate sector in agribusiness, opportunities, in the agri-business, benefits of corporate driven agri-business system involvement of corporate sector in agri-business

Unit 6: (14 Hours)

Distribution Strategy: Introduction Accessing Rural Markets, Coverage Status in Rural Markets, Channels of Distribution, Evolution of Rural Distribution Systems- Wholesaling, Rural Retail System, Vans, Rural Mobile Traders: The last Mile Distribution, Haats/Shandies, Public Distribution System, Co-operative Societies Behaviour of the Channel, Prevalent Rural Distribution Models- Distribution Models of FMCG Companies, Distribution Model of Durable Companies, Distribution of fake products, Emerging Distribution Models- Corporate –SHG Linkage, Satellite Distribution, Syndicated Distribution, ITC's Distribution Model, Petrol pumps and Extension counters, Barefoot agents, Agricultural agents, Agricultural input dealers, Other channels, Ideal distribution model for Rural

Digitalizing the Indian rural markets-e-rural marketing: select live case studies-ITC e-choupal, TARA haat, EID Parry's Indiaagriline, Kandhamal Apex Spices Association for Marketing(KASAM)

Communication strategy: Challenges in Rural Communication, A view of Communication Process, Developing Effective- Profiling the Target Audience, Determining communication objectives, designing the message, selecting the communication channels, deciding the promotion mix, Creating advertisement for rural audiences rural media- Mass media, Non-Conventional Media, Personalized media, Rural Media: The importance of the two-step flow of communication Media Typology, The Media Model, Media innovation, Influence of Consumer Behaviour on Communication strategies

Practical Components:

- Visit to the various Micro Finance Institutes, who extend their services in catering rural market.
- Visit to a village and understand the market structure and also understand the functioning part of the rural markets
- Students should come up with new product designing with the rural marketing mix 4 As (Awareness, Acceptability, Adaptability and Affordability)
- Students can do a survey on corporate farming and its effect on income of the rural farmer.

RECOMMENDED BOOKS:

- Rural Marketing - Pradeep Kashyap & Siddhartha Raut, Biztantra.
- Rural Marketing - Gopal Swamy T. P, 3/e, Vikas Publishing House.
- Rural Marketing - Dogra & Karminder Ghuman, 1/e, TMH.
- Rural Marketing - Sanal Kumar Velayudhan, 2/e, Response Publication, 2007.

REFERENCE BOOKS:

- Rural Marketing – Krishnamacharyulu C. G & Lalitha Ramakrishnan, Pearson Education.
- Rural Marketing – Habeeb Ur Rahman, 1/e, HPH, 2004.
- Rural Marketing – Minoti Kamat & R. Krishnamoorthy, 3/e, HPH.
- Agricultural Marketing In India – Acharya , Oxford I B H.
- Advertising & Marketing in Rural India- Tej K. Bhatia, 2/e, Macmillan.
- Marketing of Agricultural Products - Richard Kohls and Joseph N. Uhl, 9/e, PHI.

INTERNATIONAL MARKETING MANAGEMENT

Subject Code	: 16MBA MM406	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To introduce students to the international marketing management process, design and theories
- To develop skills relating to international trade.
- To familiarize the steps involved in import export documentation.

Outcomes

The student should be able to:

- Be aware of the differences between domestic marketing and international marketing.
- Draft international marketing Strategies
- Note down the import export documentation.

Unit 1:

(8 hours)

International Marketing – Definition and Scope – Reasons and Motivations – Global Vs Domestic Marketing – Concepts related to the management of international marketing function – World Trade and India's foreign trade: an overview – Institutional framework for exports in India.

Unit 2:

(8 hours)

International Trade Theories- Absolute cost-comparative Cost- H-O Theorem- New Trade Theories- Porter's Diamond Theory- Managerial Implications
Global marketing environment – cultural Environment Political and Legal Environment Economic Environment.- Modes of entry in to foreign business

Unit 3:

(10 hours)

India's Export – Import policy – procedure and Documentation - INCO terms - balance of trade and payments

Unit 4:

(12 hours)

International Product Policy and Planning – Need for product planning, Product adaptation, Product Standardization, Cross country segmentation, Product life cycle in International Marketing, International Packaging,
International Market selection – International Marketing Research – International marketing Planning and control.

Unit 5:

(9 hours)

International Pricing and Promotion decisions- International pricing decisions-International promotional decisions-Evaluation of international marketing performance- coordination of international marketing performance

Unit 6:

(9 hours)

International distribution strategy: International Channels – Channel alternatives – Importance of Channel decision – Factors influencing the Channel decision – Channel Selection decision – International Retailing – Role of Logistics

Practical Component:

- Select the best method of entry for doing business in this country and decide on the relevant market segments to target in the selected country and overall marketing approach.
- Review detailed guidelines for developing an international marketing plan

- Analyse international marketing environment to understand opportunities and threats that a company underlying the behaviors of international consumers and business associates.
- Conduct international marketing research to generate information on consumers, competitors and other aspects of the international marketing environment.
- Select countries for international expansion and an appropriate method of entry for international markets ranging from indirect export to joint venture to foreign direct investment.
- Market segmentation, targeting, and positioning strategy for international markets

RECOMMENDED BOOKS:

- International marketing Management – An Indian Perspective, Varshney and Bhattacharya, Sultan Chand & Sons, New Delhi.
- Global Marketing Management, Keegan, Prentice Hall of India, New Delhi.
- International Marketing, Philip Cateora and John Graham, TataMcGraw Hill, New Delhi.
- Export Management, D.C.Kapoor, Vikas Publishing House, New Delhi.

REFERENCE BOOKS:

- Essentials of International Marketing, Donald L. Brady, 1st Edition, JaicoPublishingHouse, 2011
- Export: What, Where, How, Para Ram, Anupam Publishers, Delhi.

SEMESTER IV Finance Specialisation

MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING

Subject Code	: 16 MBA FM401	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To facilitate understanding of corporate merger and acquisition activity and restructuring
- To communicate to the students the role that M&A plays in the contemporary corporate world.
- To understand how to use M & A as a strategic tool.
- To compare and contrast the various forms of corporate restructuring.
- To assess human and cultural aspects of M&A's.

Course Outcome:

At the end of the course, the students are able to:

- Understand corporate merger and acquisition activity
- Analyze the mergers & acquisition deals that have taken place in the recent past.
- Understand synergies of mergers & acquisition deals.
- Compute the valuation associated with M&A.
- Understand the human and cultural aspects of M&A's

Unit 1: (9 Hours)

Mergers- types of merger– theories of mergers- operating, financial and managerial synergy of mergers – value creation in horizontal, vertical and conglomerate mergers – internal and external change forces contributing to M & A activities- Impact of M & A on stakeholders.

Unit 2: (7 Hours)

M & A – A strategic perspective- industry life cycle and product life cycle analysis in M&A decision, strategic approaches to M&A- SWOT analysis, BCG matrix.

Unit 3: (10 Hours)

Corporate restructuring – significance - forms of restructuring – joint ventures – sell off and spin off – divestitures – equity carve out – leveraged buy outs (LBO) – management buy outs – master limited partnership– Limited Liability Partnership (LLP) in India: Nature and 91 incorporation of LLP-De merger- strategic alliance- buyback of shares.

Unit 4: (8 Hours)

Merger Process: Dynamics of M&A process - identification of targets – negotiation - closing the deal. Five-stage model – Due diligence– Types - due diligence strategy and process - due diligence challenges. Process of merger integration – organizational and human aspects – managerial challenges of M & A.

Unit 5: (12 Hours)

Methods of financing mergers – cash offer, share exchange ratio – mergers as a capital budgeting decision Synergies from M&A: Operating and Financial synergy Accounting for amalgamation – amalgamation in the nature of merger and amalgamation in the nature of purchase- pooling of interest method, purchase method – procedure laid down under Indian companies act of 1956

Unit 6: (10 Hours)

Takeovers, types, takeover strategies, - Takeover defences – financial defensive measures – methods of resistance – anti-takeover amendments – poison pills
Legal aspects of Mergers/amalgamations and acquisitions/takeovers- Combination and Competition Act- Competition Commission of India (CCI), The SEBI Substantial Acquisition of Shares and Takeover code

Practical component:

- Pick up any latest M&A deal.
- Generate the details of the deal and then study the deal in the light of the following.
- Nature of the deal: merger, acquisition, or takeover. If it is a merger, what type of merger is it?
- Synergies likely to emerge to the combining and the combined firm(s) from the deal
- The valuation for the merger
- The basis for exchange rate determination

RECOMMENDED BOOKS:

- Mergers, Restructuring And Corporate Control, Fred Weston, Kwang S Chung, Susan E Hoag, 4/e, Pearson Education.
- Corporate Finance-Theory And Practice – AswathDamodaran – John Wiley & Sons.

- Takeovers, Restructuring And Corporate Governance, Weston, Mitchell And Mulherin - 4/e, Pearson Education, 2003.
- Mergers, Ramanujam et al, TMH, 2003.
- Advanced Accounts Vol. 2 – Shukla & Grewal, S.Chand& Sons.
- Mergers and Acquisitions, Rajinder S. Aurora, Kavita Shetty and Sharad R. Kale, Oxford University Press, 2011.

REFERENCE BOOKS:

- Value Creation from Mergers And Acquisitions, SudiSudarsanam – 1/e, Pearson Education, 2003.
- Merger Acquisitions & Corporate Restructuring – Chandrashekar Krishna Murthy & Vishwanath. S.R – Sage Publication.
- Mergers, acquisitions and Corporate Restructuring, NishikantJha, Himalaya Publishing House, 2011.
- Corporate Restructuring, Bhagaban Das, DebdasRaskhit and SathyaSwaroopDebasish, Himalaya Publishing, 2009.
- Business Legislation for Management, M.C. Kuchhal and VivekKuchhal, 4/e, Vikas Publishing House, 2013.

RISK MANAGEMENT AND INSURANCE

Subject Code	: 16MBA FM402	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide an understanding of different types of risk.
- To provide an understanding of the risk identification and measurement
- To give an overview of role of Insurance in risk management.
- To comprehend insurance contracts such as Life Insurance, general insurance and marine insurance.
- To provide an understanding of the management of insurance companies

Course Outcome:

At the end of the course, the students are able to:

- Understand the process of identifying the risk.
- Recognize the complexities involved in risk identification and measurement
- Be acquainted with the function of Insurance in risk management.
- Be aware of various types of insurance contracts.
- Understand working of insurance companies.
-

Unit 1:

(10 Hours)

Introduction to Risk Management and Risk Identification: Risk-Risk and Uncertainty-Types of Risk-Burden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk

Risk Management-Risk Management Process-Identification Loss exposures-Analyzing Loss exposures-Objectives of Risk Management-Select the Appropriate Risk Management Technique-Implement and Monitor the Risk Management Program-Risk Management by Individuals and Corporations-Risk Management objectives-Need for a Rationale for Risk Management in Organizations- Understanding the cost of Risk-Individual Risk Management and the Cost of Risk-Risk Management and Societal Welfare.

Risk Identification-Business Risk Exposures-Individual Exposures-Exposures of Physical Assets -Exposures of Financial Assets -Exposures of Human Assets -Exposures to Legal Liability - Exposure to Work-Related Injury-Basic concepts form probability and Statistics.

Unit 2:

(8 Hours)

Risk Measurement-Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods-Pooling Arrangements and Diversification of Risk.

Advanced Issues in Risk Management: The Changing Scope of Risk Management-Insurance Market Dynamics-Loss Forecasting-Financial Analysis in Risk Management --Decision Making-Other Risk Management Tools

Unit 3:

(8 Hours)

Introduction to Insurance

Risk and Insurance- Definition and Basic Characteristics of Insurance-Requirements of an Insurable Risk-Adverse Selection and Insurance-Insurance vs. Gambling Insurance vs. Hedging-Types of Insurance-Essentials of Insurance Contracts.

Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India-Liberalization of Insurance Markets-Major players of Insurance.

Regulation of Insurance- Insurance Act 1938- eligibility-Registration and Capital requirement- Investment of assets-Approved investments-Licensing of insurance agents- IRDA-Duties and powers of IRDA-IRDA Act 1999-IRDA regulations for general insurance-reinsurance, life insurance, micro insurance, licensing of insurance agents, registration of insurance companies and protection of policyholders interest.

Unit 4:

(8 Hours)

Life Insurance

Basics of Life Insurance-Growth of Actuarial Science-Features of Life Insurance-Life Insurance Contract-Life Insurance Documents-Insurance Premium Calculations.

Life Insurance Classification-Classification on the Basis –Duration-Premium Payment-Participation in Profit-Number of Persons Assured-Payment of Policy Amount-Money Back Policies-Unit Linked Plans.

Annuities-Need of Annuity Contracts, Annuity V/s Life Insurance, Classification of Annuities.

Unit 5:

(12 Hours)

General Insurance-Laws Related to General Insurance-General Insurance Contract-General Insurance Corporation(GIC)-Performance Private and Public General insurance companies.

Health Insurance-Individual Medical Expense Insurance – Long Term Care Coverage – Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Child Welfare Policy-Employee Group Insurance – Features of Group Health Insurance – Group Availability Plan.

Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage.

Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy.

Motor Vehicles Insurance-Need for Motor Insurance, Types of Motor Insurance, Factors to be considered for Premium Fixing.

Unit 6:

(10 Hours)

Management of Insurance Companies

Functions and Organization of Insurers- Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers.

Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in non-life Insurance.

Claims Management-Claim Settlement in General Insurance-Claim Settlement in Life Insurance.

Insurance Pricing-Insurance Cost and Fair Premiums, Expected Claim Costs, Investment Income and the timing of claims Payments, Administrative Costs, Profit Loading, Capital Shocks and Underwriting Cycles, Price Regulation.

Insurance Marketing: Marketing of Insurance Products, Critical Success factors for Insurance Players, Marketing Strategies in India.

Practical Component

- Analyze the insurance potential in India based on secondary data
- Meet Insurance advisors. Agents and have a discussion on requirements of insurance selling.
- Select insurance company of your interest and study the risk management procedures followed by that company.
- Analyze risk management techniques used by the banks, cement companies, automobile companies.
- Visit the IRDA website and identify the rules and regulations governed by IRDA with respect to Marketing of insurance in rural markets

RECOMMENDED BOOKS

- Risk Management and Insurance, Scott E. Harrington, Gregory R Niehaus, (2007), Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Introduction to Risk Management and Insurance, Dorfman, Mark S., (2008), 10th Edition, Prentice Hall India, New Delhi.
- Principles of Risk Management and Insurance, George E Rejda, (2009), Twelfth Edition, Pearson, New Delhi.
- Insurance and Risk Management, P.K. Gupta, (2010), First Edition, Himalaya Publishing House, Mumbai.

- Principles and Practice of Insurance, P. Periasamy, (2009), Second Edition, Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:

- Risk Management and Insurance, C. Arthur Williams, Jr. Peter Young, Michael Smith, (2007), Eighth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Risk Management and Insurance, James Trieschmann, Obert Hoyt, David Sommer, (2008), Twelfth Edition, Cengage Learning, New Delhi.
- Risk management and Insurance: New Perspective in a Global Economy”, Harold D. Skipper, W. Jean Kwon, (2008), First Edition, Wiley India, New Delhi.
- Fundamentals of Risk and Insurance, Emmett J. Vaughan, Therese Vaughan, (2007), First Edition, Wiley India, New Delhi.

TAX MANAGEMENT

Subject Code	: 16 MBA FM403	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To provide the students with a comprehensive understanding of residential status in tax laws
- To acclimatize the students with process of computing tax liability of Individuals
- To understand corporate taxation system in the country
- To know the deductions and exemptions available in the tax laws
- To Provide Insight into GST

Course Outcome:

At the end of the course, the students are able to:

- Understand the process of computing residential status.
- Realize the complexities involved in tax liability of Individuals
- Know the corporate tax system.
- Be aware of deductions and exemptions of taxes
- Understand working of GST system in the country

Unit 1:

(8 Hours)

Basic concepts: assessment year, previous year, person, assessee, Income, charges on income, gross total income, capital and revenue receipts, residential status, receipt and accrual of income, connotation of income deemed to accrue or arise in India. Tax Planning, Tax Evasion and Tax Management. (Problems on residential Status of Individual assessee)

Unit 2:

(10 Hours)

Explanation under various heads of income. Income from salary (Basic problems), Income from House Property (Theory Only)

Unit 3: (10 Hours)

Income under the head Profit and Gains of Business or Professions and its computation- basic method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation (Problems on computation of income from business/ profession of Individual assessee and Depreciation).

Unit 4: (12 Hours)

Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain(theory & problems), deductions from capital gains. Income from Other Sources (Theory Only) Permissible deductions under section 80C to 80U. Setoff and carry forward of losses.

Unit 5: (10 Hours)

Computation of tax liability of a firm and partners. Computation of taxable income of a company with special reference to MAT. Corporate dividend Tax

Unit 6: (6 Hours)

Introduction to GST, Levy and exemption, Time and value of supply, Administration of GST. Introduction to **Customs duty**.

Practical Components:

- Understanding the usage of software package while calculating different taxes
- Preparation of Income tax returns of Individual assesses.
- Preparation of sales tax returns
- Studying the online submission of Income tax returns

Recommended Books :

- Direct Taxes Law and practice, Vinod Singhania and Kapil Singhania, Taxman Publications,
- Direct Tax – Lal & Vashisht – Pearson Ed. 28E.
- Students Guide to Income Tax Vinod Singhania and Kapil Singhania, – Taxman Publications
- V S Datey – Indirect Taxes – Taxman Publications.

Reference Books:

- Mehrotra- Direct Tax – Sahitya Bhavan
- T N Manoharan- Students Guide to Income Tax – Snow White

INTERNATIONAL FINANCIAL MANAGEMENT

Subject Code	: 16MBA FM404	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives

- To provide an understanding of the international economic and financial environment.
- To explain the foreign exchange rate determination, including the foreign exchange and derivatives markets.
- To describe foreign exchange exposure measurement and management.
- To provide an understanding the financial management aspects of the MNC.
- To explain the functioning of world financial markets and institutions.

Course Outcome:

At the end of the course, the students are able to:

- Be aware of international economic and financial environment.
- Understand foreign exchange rate determination.
- Know foreign exchange exposure measurement and management.
- comprehend the financial management aspects of the MNC.
- Understand the functioning of world financial markets and institutions.

Unit 1:

(6 Hours)

International financial Environment- The Importance, rewards & risk of international finance- Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution

Unit 2:

(10 Hours)

International flow of funds and International Monetary system:-

International Flow of Funds: Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade and capital flows, Agencies that facilitate International flows. BOP, Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility (problems on BOP)

International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).

Unit 3:

(10 Hours)

Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Nominal, Real and Effective exchange rates, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-Cross Rates- -

Arbitrage profit in foreign exchange markets, Swift Mechanism. Triangular and locational arbitrage.

Unit 4: (10 Hours)

International Financial Markets and Instruments: - Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, Cross listing of shares Global registered shares. International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets
International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements

Unit 5: (10 Hours)

International Parity Relationships & Forecasting Foreign Exchange rate: - Measuring exchange rate movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effect. Covered Interest Arbitrage

Unit 6: (10 Hours)

Foreign Exchange exposure: - Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure- Management of political Exposure- Management of Interest rate exposure.

Foreign exchange risk Management: Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Currency Swaps-Interest Rate Swap-Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country risk analysis.

(Question Paper: 50% Theory and 50% Problems)

Practical Component:

- Students can study the Balance of Payment statistics of India for the last five year and present the same in the class.
- Students can carry out a survey of Exporters and report the foreign exchange risk management practices adopted by them.
- Students can study the impact of exchange rate movement on the stock Index.
- Students can visit a bank and study the foreign exchange derivatives offered by them.

RECOMMENDED BOOKS:

- International Financial Management - Jeff Madura, Cengage Learning 2008. International Finance Management - Eun & Resnick, 4/e, Tata McGraw Hill.
- International Financial Management – Madhu Viji, Excel BOOKS, 2010.
- International Financial Management – Apte P. G, 6/e, TMH, 2011
- Multinational Business Finance – Eiteman, Moffett and Stonehill, 12/e, Pearson, 2011.

REFERENCE BOOKS:

- International Financial Management – Siddaiah T, 1/e, Pearson, 2011.
- International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
- International Financial Management – Vyuptakesh Sharan, 6/e, PHI, 2011.
- Multinational Financial Management – Alan C. Shapiro, 10/e, Wiley India Pvt. Ltd., 2011.

- International Financial Management – Jain, Peyrard& Yadav, Macmillan 2010.
- International Finance – Thomas O’Brien, Oxford University Press, 2010.

FINANCIAL DERIVATIVES

Subject Code	: 16MBA FM405	IA Marks	:20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the features of financial derivatives.
- To hedge risk and practice risk management using derivatives.
- Explain the use of options and futures contracts for tactical portfolio strategies purpose
- To provide an understanding of pricing financial derivatives, including familiarity with some central techniques, like the binomial model, and the Black-Scholes model
- To explain the fundamentals of credit risk management and Value at Risk

Course Outcome:

At the end of the course, the students are able to:

- Know the features of financial derivatives.
- Understand the risk management process using derivatives.
- Realize use of options and futures contracts
- Understand the pricing of financial derivatives.
- Be aware of fundamentals of credit risk management and Value at Risk

Unit 1:

(6 Hours)

Financial Derivatives - Introduction, economic benefits of derivatives - Types of financial derivatives - Features of derivatives market - Factors contributing to the growth of derivatives - functions of derivative markets - Exchange traded versus OTC derivatives - traders in derivatives markets - Derivatives market in India

Unit 2:

(12 Hours)

Futures and forwards - differences-valuation of futures, valuation of long and short forward contract. Mechanics of buying & selling futures, Margins, Hedging using futures - specification of futures - Commodity futures, Index futures, interest rate futures - arbitrage opportunities.

Interest rate markets - Type of rates, Determining Zero rates, Forward rate agreements (FRA), Interest rate derivatives.

Unit 3:

(10 Hours)

Financial Swaps - features and uses of swaps - Mechanics of interest rate swaps – valuation of interest rate swaps – currency swaps – valuation of currency swaps.

Unit 4:**(12 Hours)**

Options: Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity - mechanics of options - stock options - options on stock index - options on futures – interest rate options. Concept of exotic option. Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes Model, option Greeks. Arbitrage profits in options.

Unit 5:**(8 Hours)**

Commodity derivatives: commodity futures market-exchanges for commodity futures in India, Forward Market Commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities.

Unit 6:**(8 Hours)**

Credit risk - Bond prices and the probability of default, Historical default experience, reducing exposure to Credit risk, Credit default swaps, Total return swaps, Credit spread options, Collateralized debt obligation. Basics of Interest rate risk and risk management strategies.

Value at Risk (VAR) - Measure, Historical simulation, Model building approach, linear approach, Quadratic model, Monte Carlo simulation, stress testing and back testing

(Question Paper: 50% Theory and 50% Problems)

Practical Components:

- Students can visit a financial institution dealing in derivatives and study the products offered by them
- Students should individually select various futures or options and watch the behavior of these futures and options on a day to day for 15 days to see how futures and options might help mitigate the risks of investors.

RECOMMENDED BOOKS:

- Options Futures & Other Derivatives - John C. Hull, 6/e, Pearson Education.
- Derivatives and Risk Management, Rajiv Srivastava, Oxford University Press, 2010
- Options & Futures- Vohra & Bagri, 2/e, TMH
- Derivatives- Valuation & Risk Management - Dubofsky& Miller, Oxford University Press, 2005.
- An introduction to derivatives and risk management, Chance, Cengage, 9th edition.

REFERENCE BOOKS:

- Derivatives, Principles and Practice, Sundaram& Das, Mc Graw Hill, 2013
- Risk Management, VaijanathBabshetti& Prakash B. Yaragol, 1st edition, Kalyani Publishers, 2014.
- Introduction to Derivatives and Risk Management – Don M. Chance, Cengage Learning, 2008.
- Financial Derivatives- Bishnupriya Mishra and SathyaSwaroopDebashish, Excel BOOKS, 2007.
- Options & Futures –Edwards & Ma, 1/e, McGraw Hill.

- Derivatives & Financial Innovations - Bansal, TMH.
- Financial Derivatives –Kumar S. S. S, PHI, 2007.
- Futures, Options and Swaps – Robert W. Kolb, 5/e, Wiley India Pvt. Ltd. 2011.

CORPORATE VALUATION

Subject Code	: 16MBA FM406	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To identify the purpose of corporate valuation and to obtain an overview of the basic corporate valuation process
- To familiarize the students with the standard techniques of corporate valuation.
- To develop analytical skills and communication strategies for discussing corporate valuation.
- To assess a firm's business and competitive strategy and whether it is creating value for shareholders

Course Outcome:

At the end of the course, the students are able to

- Get an overview of the basic corporate valuation process
- Be familiar with the standard techniques of corporate valuation.
- Understand analytical skills and communication strategies for corporate valuation.

Unit 1: (8 Hours)

Corporate valuation-an Overview-Context of valuation-Approaches to Valuation-Features of the valuation process: Book value approach, Stock and debt approach, discounted cash flow approach, Relative valuation approach, option valuation approach-Features of the valuation process-Corporate valuation in practice.

Unit 2: (12 Hours)

Enterprise DCF Model-Analysing historical performance-Estimating the cost of Capital-Forecasting performance-Estimating the continuing value-Calculating and interpreting the results-Other DCF models: Equity DCF Model: Dividend discount model, free cash flow to Equity (FCFE) model-Adjusted present value model-Economic profit model-Applicability and Limitations of DCF analysis

Unit 3: (10 Hours)

Relative valuation-Steps involved in Relative valuation-Equity valuation multiples-Enterprise valuation multiples-Choice of multiple-Best practices using multiples-Assessment of relative valuation.

Other Non DCF Approaches-Book Value approach-Stock and Debt approach-Strategic approach to valuation-Guidelines for corporate valuation

Unit 4: (8 Hours)

Advanced issues in valuation-Valuation of companies of different kinds-valuation in different contexts-Loose ends of valuation-Valuation of intangible assets: Patents, trademarks, copyrights and licenses; Franchises; Brands

Unit 5: (10 Hours)

Value Based Management- Methods and Key premises of VBM-Marakon approach-Alcar approach-Mckinsey approach-Stern Stewart approach-BCG approach-Lessons from the experiences of VBM adopters.

Unit 6: (8 Hours)

Case studies in Valuation - Bharat Hotels company - Bharat Heavy Electricals Limited - Bhoruka Power Corporation Limited - Valuation in the Merger of ICICI with ICICI Bank - Sasken Communication Technologies - Valuation of Infosys Brand

(Question Paper: 50% Theory and 50% Problems)

Practical Component:

- Obtain last three years' balance sheet of any firm that has debt and equity and find out the free cash flow to the firm and free cash flow to the equity for the last three years. Also determine if there is any growth in the cash flows to the firm and to the equity holders. Find beta of the firm and compute cost of equity and WACC to finally find the value of the firm

RECOMMENDED BOOKS

- Corporate Valuation and Value Creation, Prasanna Chandra, Tata McGraw Hill, 2011.
- Valuation, AswathDamodaran, Damodaran, 2/e, John Wiley and Sons, 2006.

REFERENCE BOOKS

- Corporate Valuation: A Guide for Managers and Investors, Philip R Daves, Michael C. Ehrhardt, and Ron E. Shrieves, , Cengage Learning,2003
- Corporate Valuation Financial Times, David Frykman, JakobTolleryd, Prentice Hall, 2003.
- The Valuation Handbook: Valuation Techniques from Today's Top Practitioners, Rawley Thomas, Benton E. Gup, John Wiley & Sons, 2010
- Financial Management, Rajiv Srivastava and Anil Misra, 2/e, Oxford University Press, 2011.

**SEMESTER IV
Human Resources Management**

PUBLIC RELATIONS

Subject Code	: 16MBA HR401	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03

Total Number of Lecture Hours : 56
Practical Component : 02 Hours / Week

Exam Marks : 80

Course Objective:

- To provide an understanding of the fundamentals tools of public relations practice
- To provide a multidisciplinary understanding of the emerging trends in the field of public relations.

Course Outcomes:

The students will be able to

- Gain the insights of Public relations principles and practices.
- Learn the various theories of mass communication
- Understand the various issues in crisis management

Unit 1: (8 Hours)

Public Relation: Meaning, Concepts of PR -Proactive and Reactive Approaches – Public Relations Process – Behavioral Public Relations Model – Persuasion Model – Two way symmetrical Communications Model – 20 great truths about Public Relations

Unit 2: (8 Hours)

Theoretical basis for Public Relations –Theories of Relationships –Systems Theory – situational Theory – Theories of Persuasion and Social Influence – Social Exchange Theory – Diffusion Theory – Social Learning Theory – Elaborated Likelihood Theory - Theories of Mass communication – Uses and Gratification Theory – Agenda Setting Theory – Public Relations roles – Models of Public Relations – Approaches to Conflict Resolutions

Unit 3: (10 Hours)

Employee communications – Role of employee communication – concept of Organizational culture – Establishing Communication Policy – Organizational change – Importance of employee communication – Special employee Communication Situations – Media of Employee communications – Objectives of Internal media – Starting internal media – controlling internal media - Occasional and Special media Rules of Effective Employee Relations. Frontline supervisors as the key communicators

Case: Investing in Employees Pays Off (CJSS)

Case: Southwest Airlines – Where Fun, LUV, and Profit Go Hand –in Hand (CJSS)

Case: Employee Retention: It is the employer who is on probation (LLHT)

Case: Maintaining Employee Relationship in a Tragedy (LLHT)

Kodak Communicates One - on - One with All of its Employees (CJSS)

Unit 4: (8 Hours)

Community Relations – Importance of Public Relations – Community Relations Process – Guidelines for Effective Relations Programs -Specific Functions of Public Relations – Criteria for Community relations Activities – Corporate Social Responsibility & Philanthropy-Emerging Challenge of Community Activism

Case: Community Relationships Maintained During Hospital Closing (CJSS)

Unit 5: (8 Hours)

Media Relations – Media Relations –Role of Media in Public Relations – Social Media – working with the media –Media Relations Program Elements –Role of Technology in Public Relations

Case: Fatal Tiger Attack at San Francisco Zoo (LLHT)

Case: There's a Syringe in My Pepsi Can (CJSS)

Unit 6:

(14 Hours)

Issues in Public Relations/Crisis Management – public relations challenges –Types of Issues - target audiences-Public Service as Preventive Public Relations – Special Interests – Importance of Compromise –Issue Anticipation – Scenario Technique.

Crisis Management – Understanding how people typically react to issues – Human Nature – Role of communications – Types of crises – News media influence - Fundamental guidelines

Case: Take your choice – Tobacco or Health (CJSS)

Case: Bhopal – A Nightmare for Union Carbide (CJSS)

Practical Component:

- Related cases for each module to be discussed in the classes and presentation can be done for each case by group of students.
- Team of students can be made and asked to report the media personalities about the event held in the college. Different styles of reporting the same event can be discussed in the class with its possible reactions from the media.
- Collect the newspaper articles about various messages from organizations through spokespersons and analyze the effect of each type of delivery and impact on the audience.
- Conduct a CSR Programme for the college like Blood donation, Eye camps in association with Lions, Rotary clubs etc and gather the information's about various challenges these organizations face during such community oriented programmes.

RECOMMENDED BOOKS

- “Public Relations – The Profession and Practice”, Lattimore, Laskin, Heiman &Toth, third edition, Tata McGraw Hill, 2012 (LLHT)
- “Public Relations Practices – Managerial Case Studies and Problems” Center, Jackson, Smith and Stansbury, Seventh Edition, Prentice Hall of India, 2008 (CJSS).
- Public Relations - Paul Baines, John Egan, Frank Jefkins, Routledge, 3rd edition, 2007.
- Public Relations: Concepts, Practice and Critique, Jacquie L'Etang, SAGE, 2007.
- Public Management – Organizations, Governance and Performance, Laurence J. O' Toole Jr, Kenneth J Meier, 1st edition, Cambridge Publications, 2011.

REFERENCE BOOKS:

- Strategic Planning for Public Relations, Ronald D. Smith, revised edition, Taylor & Francis, 2004.
- Public Relations: A Practical Guide to the Basics, Philip Henslowe, 1st edition, Kogan Page Publishers, 2003.
- An Overview of the Public Relations Function - Shannon A. Bowen, Reprint Edition, Business Expert Press, 2010.
- Public Relations Practices, Managerial Case Studies and Problems, Allen H Center, Patrick Jackson, Stacey Smith, Frank R Stansberry, 7th Edition.

WORKPLACE ETHICS AND VALUE SYSTEMS

Subject Code	: 16MBA HR402	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03

Total Number of Lecture Hours : 56
Practical Component : 02 Hours / Week

Exam Marks : 80

Course Objectives:

- To understand the ethical practices at workplace.
- To address the ethical issues which arise in the work environment.
- To acquaint students with various ethical problems at work place.

Course Outcomes:

The students will be able to

- Learn the principles and practices of workplace ethics.
- Understand the concepts of corporate governance and ethics.
- Gain insights of Discrimination and Harassment at Workplace

Unit 1: (8 Hours)

Workplace Ethics: Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behavior in workplace- Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Benefits of ethics in Workplace-employee commitment, investor loyalty, customer satisfaction, profits

Unit 2; (8 Hours)

Professionalism at Workplace: Unethical Conduct for employees and employers. Factors leading to Unethical Behaviors. Different unethical behaviors. Measures to control unethical behaviors. Rewarding ethical behavior

Unit 3: (10 Hours)

Business Ethics and Corporate Governance: Overview of Business Ethics, Corporate Governance, Ethical issues in human resource management- The principal of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethics in retrenchment. Ethical Dilemmas at workplace, Ethical issues in global business, corporate responsibility of employers.

Unit 4: (10 Hours)

Workplace Privacy & Ethics: Watching what you say and what you do in the workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, Convenience and Death of Privacy, Defence of employee privacy rights.

Unit 5; (12 Hours)

Teamwork in the Workplace, Ethics, Discrimination and Harassment at Workplace & Ethics: Teams, Elements of team, Stages of team development, team meetings, team rules, and teams work and professional responsibility, rules of professional responsibility, ASME code of ethics. Discrimination, sexual harassment, creating awareness about workplace harassment, Vishaka Dutta vs. State of Rajasthan –Supreme Court directions, Compulsory workplace guidelines.

Unit 6: (8 Hours)

Managing Change in Workplace through Ethics: Introduction to Change Management, Models of change, the Ethics of Managing Change, the role of ethics and responsibilities in leading innovation and change, ethics based model for change management, ethics and risks of change management

Practical Components:

- To solve case studies on Workplace Ethics
- To visit organizations and find out the problems and causes for unethical behavior at workplace.
- To visit organizations and find out the measures adopted to control unethical behavior of employees.
- To compare and contrast the various ethical codes of conduct practiced in organizations.
- To study the recent cases on breach of workplace privacy.

RECOMMENDED TEXT BOOKS:

- Ethical Theory and Business, Tom L. Beauchamp, Norman E. Bowie and Denis Arnold, 8th Edition.
- Business Ethics – Ethical Decision making and cases O.C. Ferrell, John Fraedrich, and Linda Ferrell, 9th Edition, Cengage Learning.
- How technology is compromising Workplace Privacy, Fredrick S Lane 111, AMACOM Div American Mgmt Assn, 2003
- Ethics in the Workplace, Dean Bredeson, Keith Goree, Cengage Learning, 2011.

REFERENCE BOOKS:

- Ethics in 21st Century, Mary Alice Trent, Oral Roberts University, longman.
- Ethics in workplace, Elizabeth P Tierney, Oak tree press
- Ethics in Workplace: System Perspective, William F Roth, Pearson, 2014.
- Ethics in the Workplace: Tools and Tactics for Organizational Transformation - Craig E. Johnson - SAGE Publications, 2007
- Business Ethics: Fairness and justice in the workplace - Volume 2 of Business
- Ethics, Fritz Allhoff, ISBN 1412902541, 9781412902540 - SAGE Publications, 2005

INTERNATIONAL HUMAN RESOURCE MANAGEMENT

Subject Code	: 16MBA HR403	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To analyze the impact of contemporary issues and global imperatives on Human Resource concepts
- To learn the policies and practices in multinational organizations
- To compare, contrast and explain a variety of strategic approaches to the management of Human Resources in multinational organizations.

Course Outcomes:

The students will be able to

- Apply the concepts and knowledge about the range of Human Resource functions.
- Deploy the expatriate employees and expatriate failures on international assignments.
- Evaluate the effects of different Human Resource and International Industrial Relations strategies adopted by multinational organizations

Unit 1: (10 Hours)

Introduction to IHRM Definition, The drivers of internationalization of business. The different setting of International Human Resource Management. Development of IHRM. Difference between IHRM and Domestic HRM. Models of IHRM-Matching model, Harvard Model, Contextual Model, 5P Model European Model. SHRM: Evolution of MNE's, Business strategies, IHRM Strategies, SIHRM. Barriers in effective global HRM. Socio-cultural context, Organizational dynamics and IHRM: Role of culture in International HRM, Country and Regional Cultures, Country Culture versus MNE Culture. Culture and employee management issues/ impact of Country culture on IHRM.

Unit 2: (7 Hours)

Strategies for International Growth: Exploiting global integration-The logic of global integration, differentiation, Mastering expatriation, beyond the traditional expatriate model, the limits of global integration. Becoming locally responsive: The roots of responsiveness, understanding diversity, responding to diversity, the challenges of localization. Managing alliances and joint ventures - IHRM and International Alliances, IHRM and International Joint Ventures.

Unit 3: (10 Hours)

International Workforce planning and staffing: International labour market International Recruitment function; head-hunters, cross-national advertising, e-recruitment; International staffing choice, different approaches to multinational staffing decisions, Types of international assignments, Selection criteria and techniques, use of selection tests, interviews for international selection, international staffing issues, Successful expatriation, role of an expatriate, female expatriation, repatriation, re-entry and career issues.

Unit 4: (7 Hours)

Developing Global Mindset: Global Leadership, Cross cultural context and international assignees, Current scenario in international training and development, training & development of international staff, types of expatriate training, sensitivity training, Career Development, repatriate training, developing international staff and multinational teams, knowledge transfer in multinational companies.

Unit 5: (8 Hours)

Performance Management: Performance Management and MNE, Constraints in goal attainment, performance management cycle, Performance Management of International Assignees, third and host country employees, issues and challenges in international performance management, country specific performance management practices.

Unit 6: (14 Hours)

International Compensation and International Employment Laws and HRIS: International compensation and international assignees, Forms of compensation, key components of international compensation, Approaches to international compensation, compensation practices across the

countries, emerging issues in compensation management. Establishment of labour standards by International Institutions, The global legal and regulatory context of MNE, The International framework of Ethics and Labour standards, Key issues in International Industrial Relations, Trade Unions and MNE's, Response of Trade Unions to MNE's, Non-Union worker representation. HRIS: Meaning, Role of IT in HR, Designing of HRIS, Applications of HRIS in Employee Management, Limitation of HRIS.

Practical Component:

- Study the Socio-Political-Economic System in U.S, U.K, Japan and India and prepare a comparative analysis.
- Visit an MNE organization and study the HR shared services operations performed.
- Solve a case study to understand the challenges faced by organizations in evaluating the performance of international assignees.
- Study and compare Recruitment, Selection and Training practices in various countries.
- Study Indian and US legal aspects involved when deploying an employee on an International Assignment.

RECOMMENDED BOOKS:

- International Human Resource Management - Peter J. Dowling, MavinFesting, Allen D Englesr Cengage Learning.
- International Human Resource Management - Monir H. Tayeb, Oxford University Press, 2005.
- Human Resource Information Systems: Basics, Applications, and Future Directions: Basics, Applications, and Future Directions, Michael J. Kavanagh, Mohan Thite, Richard D. Johnson SAGE, 2011, 2/e.
- Strategic International Human Resource Management: Choices and Consequences in Multinational People Management - Stephen J. Perkins, Susan M. Shortland – Kogan Page Publishers, 2006.
- Strategic Human Resource Management, Schuler, 2/e, Wiley.

REFERENCE BOOKS:

- International Human Resource Management: Text and Cases By P. L. Rao, Excel Books, Reprint
- International Human Resource Management: Policies and Practices By Dennis Briscoe, Randall Schuler, IbraizTarique, Taylor & Francis, 4/e, 2012.
- International Human Resource Management - Anne-Wil Harzing, Joris Van Ruysseveldt - SAGE, 2004.
- International human resource management: think globally, act locally – Derek Torrington - Prentice Hall, 1994.

ORGANISATION CHANGE AND DEVELOPMENT

Subject Code	: 16MBA HR404	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the concepts of change management and to acquire the skills required to manage any change effectively.
- To understand the various components and constraints involved in Change management.
- To learn the various tools & techniques for Organization Development
- To understand the different OD interventions and its effectiveness.

Course Outcomes:

The students will be able to

- Gain insights of change management components, process and its functions
- Enable with various OD diagnosing models
- Ability to handle various OD interventions.

Unit 1: (8 Hours)

Organizational change- Introduction, nature of change, Internal & External changes, types of change, **Models of change-** Lewis's Force field, Systems Model, Action research model, organizational vision and strategic planning.

Unit 2: (8 Hours)

Resistance to change- reasons for the resistance, overcoming resistance for the change, change and person and manager, systematic approach to making change- factors for effective change, skills of leaders in change management, designing the change.

Unit 3: (8 Hours)

Organization development-Introduction, history, evolution of OD, OD interventions: Definition, actors to be considered, choosing and sequencing, intervention activities, classification of OD interventions, results of OD, typology of interventions based on target groups.

Process of Organization Development: Entering into OD relationship, developing a contract.

Unit 4: (8 Hours)

Diagnosing Organizations- Need for diagnostic models, organization, group, individual level diagnosis, Collecting and analyzing the diagnostic information, Feeding Back of diagnostic information, Designing interventions, overview of interventions, evaluating and Institutionalizing OD Interventions.

Unit 5: (12 Hours)

Human Process Interventions: Human process interventions (individual, group and inter-group human relations): **Individual based:** coaching, counselling, training, behavioral modelling, delegating, leading, morale boosting, mentoring, motivation, etc., **Group based:** conflict management, dialoguing, group facilitation, group learning, self-directed work teams, large scale interventions, team building, and virtual teams.

Inter-group based: Organization mirroring, third party peacemaking interventions.

Unit 6: (12 Hours)

Techno-structural Interventions and Future of OD: Restructuring Organizations, Employee Involvement, work Design, Balanced scorecard; business process reengineering; downsizing and outsourcing; **Strategic Interventions:** Competitive and Collaborative Strategies, Organization Transformation.

The Future of OD: The changing environment, Fundamental strengths of OD, Implications of OD for the client, ethical standards in OD, OD's future. **OD Consultant's role**, issues in consultant-client relationship, Power, Politics & OD, Research on OD.

Practical Component:

- To conduct Force field analysis for MBA department
- Group activity-Identify the need for OD intervention for your college and call the director/principal of your college to the classroom to explore the possibility for OD intervention.
- Presentation by students: Identify and explore the possibility for OD intervention in your college level, group level and individual level.
- Hold a debate in the classroom about downsizing the workforce.
- Organization change questionnaire data collection and analyzation.
- Group Presentation: Health care, FOO, Education, PSU, Retail, Manufacturing Industries.
- Design a role play event for students, so that they will play it out to mobilize support for a change implementation programme.

RECOMMENDED BOOKS:

- Theory of Organization Development and Change. Thomas G. Cummings, Christopher G. Worli, Cengage Learning.
- Understanding the theory and design of organization, Richard L Draft, Cengage Learning.
- Organization Development, behavioral science interventions for Organization Improvement, Wendell French, Cecil H.Bell, Veena, Jr, Pearson, PHI.
- Organization Change and Development, Kavith Singh, Excel BOOKS.

REFERENCE BOOKS:

- Change & Knowledge Management-R.L. Nandeshwar, Bala Krishna Jayasimha, Excel BOOKS, 1st Ed.
- Management of Organizational Change – K Harigopal – Response BOOKS, 2001
- Organizational, Design, and Change-Gareth R. Jones, 5th Edition, Pearson Education

STRATEGIC TALENT MANAGEMENT

Subject Code	: 16MBA HR405	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To aware the challenges of acquisition and retention of talents for the competitive advantage of the organization.
- To develop a conceptual understanding of the management of talents in the competitive environment.
- To understand how important is to develop and retain the best talents in the industry.
- To understand the concepts of competency and its usage in evaluating a person's work.
- To get an idea about different tools in identifying required competencies in a person.

Course Outcomes:

The students will be able to

- Gain the insights of talent management practices in organization.
- Learn the techniques and retail the best talent in industry.
- Prepare competency mapping.

Unit 1: (10 hours)

Basics of Talent Management: Talent- engine of new economy, difference between talents and knowledge workers, leveraging talent, the talent value chain, elements of talent friendly organizations, talent management process, **Talent Management System** – Components and benefits of Talent Management System; creating TMS, challenges of TMS, **Building blocks of talents management:** competencies – performance management, conducting performance reviews, Appraising executive talent, selecting the right appraisal.

Unit 2: (8 hours)

Talent Planning – Concept, succession management process, Integrating succession planning and career planning, designing succession planning program, strategic accountability approach in developing the workforce, balanced scorecard, talent development budget, contingency plan for talent; building a reservoir of talent, compensation management within the context of talent management, CEO Succession planning,

Unit 3: (6 hours)

Developing and Retaining Talent – Potential identification and development, coaching for sustained & desired change, integrating coaching, training and development with talent management ,employee retention- motivation and engagement, Return on talent; age of analytics, making outplacement as a part of talent strategy, developing talent management information system.

Unit 4: (6 hours)

Competency mapping: Concepts and definition of competency; types of competencies, competency based HR systems, competency and performance, 5 level competency model, developing various competency models, how competencies relate to career development and organizational goals.

Unit 5: (14 hours)

Methodology of competency mapping : competency model development ,competency models, people capability maturity model ,developing competency framework , competency profiling , competency mapping tools , use of psychological testing in competency mapping , competency based interviewing , assessment of competencies through 360 degree feedback, BEI, CIT, validation of competencies.

Unit 6: (12 hours)

Measuring Performance, Assessment and Development Centre: background and approaches to performance assessment, competency based performance assessment, diagnosing reasons for performance problems, designing an effective performance management systems, sources of errors in performance measurement.

Assessment and Development Centre : concepts , importance and uses of assessments centre in selecting employees , difference between assessment and development centre, assessment centre

approach to competence building , profile of the assessors, steps in assessment centre, designing the assessment centre.

Practical Component:

- Students are expected to conduct a study on how talents are acquired and retained – in various industries – and various strategies followed by the respective companies.
- Discussion on “How to have/ evaluate the performance of the MBA students”
- Ask the students to find out the best employer surveys conducted during the past one year and make a presentation.
- Identify the important positions in your college or any other organization and ascertain the measures if any taken to develop second line of leadership
- Ask the students to collect data about the position of principal, director, and other teachers in your college and prepare a competency dictionary for the said positions
- Presentation by students about the competency directory profiling of various positions.
- Ask the students to role play the behavioural event interview to collect data for competency mapping for the position of management professor.
- Presentation by students about the competency directory profiling of various positions.

RECOMMENDED BOOKS:

- The Talent Management Hand Book – Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill
- Competence at work – Lyle M. Spencer, Signe M. Spencer. John Wiley, 1993.
- A Handbook of Competency Mapping – Seema Sangi, Response BOOKS, 2004.
- Competency mapping, Assessment and Growth – Naik G.P, IHRM, 2010.

REFERENCE BOOKS:

- The Talent Era, Chowdhary, Subir, Pearson Education, New Delhi.
- Appraising & Developing Managerial Performance- Rao T. V, Excel BOOKS
- Performance Management – Herman Aguinis, Pearson Education, 2007.
- Performance Management, Rao, Wiley.

PERSONAL GROWTH AND INTERPERSONAL EFFECTIVENESS

Subject Code	: 16MBA HR406	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To identify strengths and weaknesses as an individual, as a member of a group/organization using personality types.
- To understand the concepts of self awareness, self esteem, NLP and Locus of Control.
- To understand Interpersonal growth and effectiveness.

Course Outcomes:

The Students will be able to:

- Understand the components of personal growth.
- Gain insights in the aspects of interpersonal growth and handling conflicts, managing time, self analysis to name a few.

Unit 1: (12 Hours)

Personal growth: Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organizational roles, role clarity and role boundaries. Ego states- Id, ego and super ego and defense mechanisms; developing a self improvement plan.

Interpersonal Trust: Discovering facets of interpersonal trust through Johari Window (Openness, confidentiality, blind spot and unknown part of personality); Self disclosure, seeking feedback, self reflection and practicing new behaviors.

Unit 2: (8 Hours)

Understanding Human Personality: Personality – Meaning & Determinants; Personality theories, Carl Jung's theory of personality Types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B Personalities; Emotional intelligence – Meaning, Dimensions, and Emotionally intelligent Organizations.

Unit 3: (8 Hours)

Attitudes, beliefs, Values and their impact on behavior; Personal change- meaning, nature and requisites. Locus of control. **Habit Formation** - Habits of personal effectiveness. Seven habits of highly effective people.

Unit 4: (8 Hours)

Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming (NLP).

Unit 5: (6 Hours)

Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, Time management and honoring the commitments

Unit 6: (14 Hours)

Transactional Analysis: Ego states, types of transactions and time structuring. Life position, scripts and games; strokes and stamps

Experiential learning methodologies: T-group sensitivity training, encounter groups and appreciative enquiry.

Practical Components:

- Students are expected to conduct an in depth study about various personality traits & TA and submit a detailed report.
- Students have to undergo psychometric test like MBTI, FIRO-B, Big Five etc , conduct SWOT analysis and prepare a personal growth plan based on the results

- Ask the individual students to seek multisource feedback about their interpersonal effectiveness from peers, teachers, and parents; understand and reflect the feedback and prepare a development plan for interpersonal effectiveness.
- Discuss a Johari Window case in the class to identify how it can help each individual student to promote his/ her personal growth.
- Organize a workshop on MBTI for the students to know their type and to understand the type dynamics.
- Organize a neuro linguistic programming workshop for the participation of all HR students.

RECOMMENDED BOOKS:

- Organizational Behaviour: Human Behavior at work – John W. Newstrom and Keith Davis, 11/e, Tata McGraw Hill, 2003.
- Human Relations in organizations - Robert N. Lussier, 6/e, Mc-Graw Hill Education.
- Development of Management Skills - Whetten& Cameron, 7/e, PHI.
- Competency Mapping Assessment and Growth - Naik G.P, IHRM, 2010.

REFERENCE BOOKS:

- Understanding OB - Udai Pareek, Oxford University Press.
- Theories of Personality- Calvin S Hall, 4/e, Wiley India Pvt. Ltd.
- Seven habits of highly effective people - Stephen R Covey, Pocket Books.
- Training in interpersonal Skills- Stephen Robbins, Pearson Education.

**GUIDELINES FOR INTERNSHIP STUDY (16MBAIN307)
(BETWEEN 2ND AND 3RD SEMESTER MBA)**

OBJECTIVE

To expose the students to understand the working culture of the organization and apply theoretical concepts in real life situation at the work place for various functions of the organization.

STRUCTURE

The Internship shall consist of Study of an organization for 4 weeks.

GENERAL GUIDELINES

- The Internship shall be for a period of 4 weeks immediately after the completion of 2nd Semester Examinations but before the commencement of the 3rd semester classes
- The Subject code of the project work report shall be 16MBAIN307 and shall be compulsory for all the students.
- No two students of an institute shall work on the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance. Student need to identify an external guide (Working in the organization) and seek guidance from him/her.

Format of the internship report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1” margin all sides and 1.5line spacing. The internship report shall not exceed 60 pages.

Submission of Report: Students shall submit one hard copy of the report to the college and a soft copy in PDF file (Un-editable Format).

Evaluation:

- Internal evaluation will be done by the internal guide.

- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective institution where a student is expected to give a presentation of his/ her work. The viva –voce examination will be conducted by the respective HOD or Senior Professor or internal Guide of the department and an external evaluator drawn from industry. In case of non availability of industry person, a senior professor or a faculty with more than 10 years of experience may be invited to conduct the viva-voce. Internship work carries 100 marks consisting of 50 marks for internship report (evaluated by internal guide and 50 marks for viva-voce examination)

Contents of the Internship Report

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution(scanned copy) indicating bonafide performance of internship by the student
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction about the internship, Industry Profile.

Chapter 2: Organization Profile:

- i. Back ground,
- ii. Nature of business,
- iii. Vision mission, quality policy
- iv. Product/service profile
- v. Ownership pattern
- vi. Achievements/awards if any
- vii. Future growth and prospects

Chapter 3: Mckensy's 7S framework with special reference to organization under study.

Chapter 4: SWOT Analysis

Chapter 5: Analysis of financial statement. in brief.

Chapter 6: Learning experience.

Bibliography

Annexure relevant to the Internship study such as figures, graphs, photographs etc.,

GUIDELINES FOR 10 WEEK PROJECT WORK (16MBAPR407) (BETWEEN 3RD AND 4TH SEMESTER MBA)

OBJECTIVE

To expose the students to understand the working of the organization/ company / industry and take up an in-depth study of an issue / problem in the area of specialization.

GENERAL GUIDELINES

- The project work shall be for a period of 10 weeks immediately after the completion of 3rd Semester Examinations but before the commencement of the 4th semester classes
- The Subject code of the project work report shall be 16MBAPR407 and shall be compulsory for all the students opting for all specializations.
- The University shall receive 3 copies of project reports prior to the commencement of the 4th semester examination. Copies of the project report should be sent to the concerned Regional Office with an intimation to the Registrar (Evaluation)
- No two students of an institute shall work on the same problem in the same organization
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
- The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size
- All the reports shall be printed in the A4 size 1” margin on all the sides.

- The report shall be hard bound facing sheet indicating the title of college and month & year of admission (spiral binding not permitted)
- A certificate by the guide, HOD and Head of the institution indicating the bonafide performance of the project by the student to be enclosed.
- An undertaking by the student to the effect that the work is independently carried out by him.
- The certificate from the organization.
- Acknowledgement
- Executive Summary

Schedule to be followed before commencement of Project

Activity	Time line	Remarks
<ul style="list-style-type: none"> • Identifying the organization • Problem identification 	First two weeks	Student individually identifies an organization and identifies problem for his/her study, according to his/her interest.
Problem statement	3rd week	His/ Her interests are discussed with selected guides
Research Design	4th week	Discussion with Internal Guide to decide on suitable design for the research
Synopsis Preparation	5th and 6th week	Preparation of Synopsis* incorporating the objectives

Presentation of Synopsis	7th and 8th week	The student will present the synopsis with the detailed execution plan to the Internal Guide and HOD who will review and may: a. Approve b. Approve with modification or c. Reject for fresh synopsis
Approval Status	9th and 10th week	The approval status is submitted to HOD who will officially give concurrence for the execution of the Project

*Synopsis: It is a three page document or hard copy to be submitted to the HOD with the signatures of the Guide and the student.

Page 1	Title, Contact Address of student- with details of Internal and External Guide
Page 2	Short introduction with objectives and summary (300 words). Review

	of Articles / Literature about the topic with source of information
Page 3	Time Activity Chart

Schedule to be followed during Project work

Activity	Time Line	Remarks
Understanding Structure, Culture and functioning of the organization	First 2 weeks of Project	Student should understand products/services and the problems of the organization.
Preparation of Research instrument for data collection	3rd and 4th week of Project	Discussion with the guide for finalization of research instrument in his/her domain and present the same to the guide. (First Presentation)
Data collection	5th and 6th week of Project	Data collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second Presentation)
Analysis and finalization of report	7th and 8th week of Project	Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use Statistical Package whose

		result should be shown in the report) (Third Presentation)
Submission of Report	9th and 10th of Project	Final Report should be submitted to the University before one week of the commencement of theory examination

Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by a faculty member of other institute drawn from VTU affiliated institute with minimum of 10 years of experience.
- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective Institution where a student is expected to give a presentation of his/ her work.
- The viva –voce examination will be conducted by the respective HOD / Senior Professor of the department and an expert drawn from the VTU affiliated institutes with minimum of 10 years of experience as appointed by the University.
- Project work carries 200 marks consisting of 50 marks for internal valuation by the internal guide, 50 marks for external evaluation and 100 marks for viva-voce examination.
- **Format of the project report** shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout

of A4 size with 1” margin all sides and 1.5 line spacing. The Project report shall not exceed 100 pages.

- **Submission of Report:** Students should submit the Project Report in electronic data form only, in **PDF** file (Un-editable Format) to the Institute. The Institute in turn shall submit all the CD’s of their students along with a consolidated master list as per specialization containing USN, Name of the student, and Title of the Report to Registrar (Evaluation) one week before the commencement of the Theory Examinations.
- **Plagiarism:** Plagiarism is considered as academically fraudulent, and an offence against University academic discipline. The University considers plagiarism to be a major offence, and subject to the corrective procedures. It is compulsory for the student to get the plagiarism check done before submission of the project report. Plagiarism of up to 25% is allowed in the project work and report should consist 75% of original content/work.
- **Publication of Research Findings:** Students are expected to present their research findings in Seminars/Conferences/Technical/Management Fests or publish their research work in Journals in association with their Internal Guide. Appropriate Weightage should be given to this in the internal evaluation of the project report.

Contents of the Project Report

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy)
- indicating bonafide performance of Project by the student

- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction

Introduction, Industry profile and company profile: Promoters, vision, Mission & Quality Policy. Products / services profile areas of operation, infrastructure facilities, competitors' information, SWOT Analysis, Future growth and prospects and Financial Statement

Chapter 2: Conceptual background and Literature review

Theoretical background of the study, Literature review with research gap (with minimum 20 literature reviews).

Chapter 3: Research Design

Statement of the problem, Need for the study, Objectives, Scope of the study, Research methodology, Hypotheses, Limitations, Chapter scheme.

Chapter 4: Analysis and Interpretation

Analysis and interpretation of the data- collected with relevant tables and graphs. Results obtained by the using statistical tools must be included.

Chapter 5: Findings, Conclusion and Suggestions

Summary of findings, Conclusion and Suggestions / Recommendations

Bibliography

Annexure relevant to the project such as figures, graphs, photographs etc.,

Marks allocation for IV Semester Project Report

Evaluation by Internal guide

SL. No	Aspects	Marks
01	First Presentation	05
02	Second Presentation	05
03	Third Presentation	10
04	Introduction and Methodology	05
05	Industry and Company Profile	05
06	Theoretical background of study	05
07	Data analysis and interpretation	10
08	Summary of findings, suggestions and conclusion	05
	Total	50

Evaluation by faculty member drawn from VTU institutions.

SL. No	Aspects	Marks
1	Introduction & Relevance of the project	10
2	Conceptual background and literature review	05
3	Research design	05
4	Analysis and interpretation	20
5	Summary of findings, suggestions and	10

	conclusion	
	TOTAL	50

Viva voce conducted by HOD/Internal Guide and an Expert from VTU.

SL. No	Aspects	Marks
1	Presentation skill	10
2	Communication skills	10
3	Subject knowledge	20
4	Objective of the study or methodology	20
5	Analysis using statistical tools and statistical packages	20
6	Findings and appropriate suggestions	20
	TOTAL	100

Formats for Project Report and Evaluation

- Format of Cover Page
- Format of certificate by College/Institution
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

(Title of the Report)

BY

(Student Name)
(USN)

Submitted to

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
In partial fulfillment of the requirements for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION

Under the guidance of

INTERNAL GUIDE
(Name)
(Designation)

EXTERNAL GUIDE
(Name)
(Designation)

(Institute Logo)

Department of MBA
(Institute Name with Address)

(Month & Year of submission)

CERTIFICATE

This is to certify that **(Name of the Student)** bearing USN (xxxx), is a bonafide student of Master of Business Administration course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgaum. Project report on **“(Title of Report)”** is prepared by Him/her under the guidance of **(Name of the Guide)**, in partial fulfillment of the requirements for the award of the degree of Master of Business Administration of Visvesvaraya Technological University, Belgaum Karnataka.

Signature of Internal Guide

Signature of HOD

Signature of Principal

DECLARATION

I, **(Student Name)**, hereby declare that the Project report entitled “(Title)” with reference to “(Organisation with place)” prepared by me under the guidance of **(Guide Name)**, faculty of M.B.A Department, **(Institute name)** and external assistance by **(External Guide Name, Designation and Organisation)**. I also declare that this Project work is towards the partial fulfillment of the university Regulations for the award of degree of Master of Business Administration by Visvesvaraya Technological University, Belgaum. I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place:
Date:

Signature of the student

TABLE OF CONTENTS

Executive Summary

Chapter 1.Introduction.....(Page Number)

Chapter 2.Industry and Company profile.....(Page Number)

Chapter 3. Theoretical Background of the Study(Page Number)

Chapter .4 Data Analysis and interpretation.....(Page Number)

Chapter .5 Summary of Findings, suggestions and Conclusion.....(Page Number)

Bibliography

Annexure

LIST OF TABLES

Table No.	Particulars	Page Nos.
Table - 4.1	Table showing ABC Analysis	
Table – 4.2	Table showing FSN Analysis	

Table – 4.3	Table showing EOQ	
Table – 4.4	Table showing stock of Raw materials	

LIST OF FIGURES AND CHARTS

Chart No.	Particulars	Page Nos.
Chart - 4.1	Graph showing ABC Analysis	
Chart - 4.2	Graph showing FSN Analysis	
Chart - 4.3	Graph showing EOQ	
Chart - 4.4	Graph showing stock of Raw materials	

BIBLIOGRAPHY

BOOKS:

1. Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.

ARTICLES:

1. Name of the Author, Title of the article, Name of the Journal, Volume Number, Issue Number, Year, Page Number (pp)

WEBLIOGRAPHY

1. Name of the Author, Title of the article, retrieved on mm/dd/yy, from URL

Visvesvaraya Technological University

Internal Evaluation Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	First Presentation	05
2	Second Presentation	05
3	Third Presentation	10
4	Introduction	05
5	Conceptual background	05

	and literature review	
6	Research design	05
7	Analysis and interpretation	10
8	Summary of findings, suggestions and conclusion	05
	TOTAL	50

Marks Sheet:

SL.No	USN		1	2	3	4	5	6	7	8	Total
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Signature of the Guide with Date

Visvesvaraya Technological University

External Evaluation Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	Introduction & Relevance of the project	10
2	Conceptual background and literature review	05
3	Research design	05
4	Analysis and interpretation	20
5	Summary of findings, suggestions and conclusion	10
	TOTAL	50

SL.No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							
6							

7							
8							
9							
10							

Signature of External Examiner with affiliation

Signature of HOD

Visvesvaraya Technological University

Viva-Voce examination Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	Presentation skill	10
2	Communication skills	10
3	Subject knowledge	20
4	Objective of the study or methodology	20
5	Analysis using statistical tools and statistical packages	20
6	Findings and appropriate suggestions	20
	TOTAL	100

SL.No	USN	1	2	3	4	5	6	Total
1								
2								
3								
4								
5								

Signature of External Examiner with affiliation

Signature of HOD

Syllabus of Master of Business Administration

(With effect from 2012-13)

MBA



**Visvesvaraya Technological University,
Belgaum**

Web: www.vtu.ac.in

e-Mail: info@vtu.ac.in

Regulations Governing

THE MASTER OF BUSINESS ADMINISTRATION

OMB 1 TITLE OF THE COURSE

OMB 1.1 The course shall be called Master of Business Administration course which is abbreviated as MBA.

OMB 2 DURATION OF THE COURSE

OMB 2.1 The MBA course shall be of two years' duration, extended over four semesters.

OMB 2.2 The candidates shall be allowed a maximum of four years (8 semesters) of duration to be eligible for the award of MBA degree, failing which he / she shall have to register once again as a fresh candidate.

OMB 3 ELIGIBILITY FOR ADMISSION

OMB 3.1 Admission is open, to the Master of Business Administration Course, to all the candidates who possess a Bachelor's Degree of minimum three years' duration recognized by this university or who have passed any other examination recognized by this university as equivalent thereto.

OMB 3.2 The candidates shall have passed the prescribed qualifying examinations with not less than 50% of the marks in aggregate of all the years / semesters of the degree examinations. However, in the case of candidate belonging to SC/ST and any other groups classified by the Government of Karnataka for such purpose from time to time, the aggregate percentage of marks in the qualifying examinations shall be not less than 45%.

OMB 3.3 Government seats and Management seats in colleges shall be filled as per the Government Order issued from time to time in this regard.

OMB 3.4 All graduates other than the graduates of VTU shall have to obtain Eligibility Certificate from the VTU to seek MBA admissions in any of the colleges affiliated to VTU.

OMB 3.5 The Calendar of events in respect of the course shall be fixed by the University from time to time.

OMB 4 ATTENDANCE REQUIREMENT

OMB 4.1 Each semester of the course shall be treated as a separate unit for calculation of the attendance.

OMB 4.2 A candidate shall be considered to have satisfied the attendance requirement if he / she has attended not less than 85% of the classes in each subject of the respective semesters (Theory, Seminars, Practical Training, etc) actually conducted up to the end of the semester.

OMB 4.3 A candidate, who does not satisfy the attendance requirement, mentioned as above, shall not be eligible to appear for the Examination of the semester and shall be required to repeat that semester along with regular students during the subsequent year.

OMB 4.4 If a candidate, for any reason, discontinues the course after the first / third semester he / she may be permitted to register for the second / fourth semester, after one year with the immediate subsequent batch, subject to the condition that he / she shall complete the class work and seminar including the project / internship within maximum stipulated period of four years from the date of commencement of the course.

OMB 4.5 The Principals of the concerned Colleges shall display regularly, the list of such candidates who fall short of attendance, on the notice boards.

OMB 4.6 The list of the candidates falling short of attendance shall be sent to the University at least one week prior to the commencement of examination.

OMB 5 INTERNAL ASSESSMENT

OMB 5.1 Each candidate shall obtain not less than 50% of the marks prescribed for the Internal Assessment of each subject, including seminars.

OMB 5.2 Internal Assessment Marks shall be based on assignments / tests / oral examinations / Practical Components and seminar conducted in respective subjects.

OMB 5.3 Candidates obtaining less than 50% of the Internal Assessment marks in any subject shall not be eligible to appear for the examination in that subject. However, the Head of the Department may arrange for the improvement of Internal Assessment marks in the subject / subjects in subsequent semesters and the candidate be provided an opportunity for taking the examination at the end of the immediate subsequent semester to fulfill the provisions of OMB 5.1.

OMB 5.4 The student shall write the Internal Assessment Test in Blue Books which shall be maintained by the Principal for at least one month after the announcement of result for verification by the University Officials.

OMB 5.5 Every sheet of Internal Assessment marks list shall bear the signatures of the concerned Teacher, Head of the Department and the Principal of the Institution.

OMB 5.6 The Internal Assessment marks list shall be displayed on the Notice Board and corrections, if any, shall be incorporated before sending to the University.

OMB 5.7 No corrections of the Internal Assessment marks shall be entertained after the submission of marks list to the University.

OMB 6 PAPER SETTING AND EVALUATION OF THEORY ANSWER PAPER

OMB 6.1 Question papers in theory subjects shall be set by the Examiners appointed for that purpose by the University.

OMB 6.2 There shall be double valuation of theory papers in the University Examinations. The Answer Papers shall be valued by two examiners appointed by the University.

OMB 6.3 If the difference between the marks awarded by the two Examiners is not more than 15 per cent of the maximum marks, the marks awarded to the candidate shall be the average of two evaluations.

If the difference between the marks awarded by two examiners is more than 15, the script shall be evaluated by a third examiner. The average of marks of nearest two valuations shall be considered as marks secured by the candidate. However, if one of the three marks falls exactly midway between the other two, then the highest two marks shall be taken for averaging.

OMB 7 INTERNSHIP (PROJECT WORK)

OMB 7.1 All the candidates shall undertake an Internship (Project Work) of twelve weeks' duration during the fourth semester. The Internship should have industry orientation and the work should be certified by the concerned organization where the student has undertaken the Internship.

OMB 7.2 The Internship report shall be submitted by the students as per the guidelines prescribed by the university from time to time.

OMB 7.3 For the Project work (Internship), the Internal Guide shall carry out the internal assessment for 100 marks.

OMB 7.4 An external examiner shall separately value the Internship report for 100 marks. A Viva voce examination for 100 marks shall be jointly conducted by a panel of examiners consisting of an external and internal examiner. This examination has to be conducted in batches of 5 students. The Internship marks will be included in the 4th semester scheme.

OMB 7.5 A candidate shall secure a minimum of 50% of marks in aggregate (in the internal assessment, evaluation of Internship report and viva voce examination). In the event of his failing to secure the 50% marks, he shall have to re-do the Internship.

OMB 8 ELIGIBILITY FOR PASSING

OMB 8.1 There shall be a university examination at the end of each semester.

OMB 8.2 A candidate shall obtain a minimum of 40% of marks in the University Examination and a minimum of 50% of marks in the aggregate including the Internal Assessment marks for passing in a theory subject. The passing marks in the internship shall be as provided under OMB 7.5 and 8.4.

OMB 8.3 There shall be no restriction for promotion of a candidate from the first semester to the second semester and from the third semester to the fourth semester provided he/she has fulfilled the attendance requirement as per OMB 4.2.

OMB 8.4 A candidate who has not failed in more than four heads of passing from the first and second semester put together shall be eligible for promotion from the second semester to the third semester.

OMB 9 AWARD OF CLASS & RANK

OMB 9.1 The candidates, who have passed in all the subjects of all four semesters and in the internship, shall be declared to have passed the course.

OMB 9.2 Classes shall be awarded to the candidates who have passed in all subjects at each semester on the aggregate marks obtained by them in the first attempt at the respective semester.

OMB 9.3 A candidate who secures 70% and above marks in aggregate in first attempt shall be declared to have passed in first class with distinction.

OMB 9.4 A candidate who secures 60% or more marks but less than 70% in aggregate in first attempt shall be declared to have passed in first class.

OMB 9.5 A candidate who secures 50% or more marks but less than 60% in aggregate in first attempt shall be declared to have passed in second class.

OMB 9.6 Classes shall be awarded at the degree level to the candidates who have completed the Course based on the first attempt aggregate of all four semesters taken together.

OMB 9.7 The number of ranks declared at degree level shall be 10 or 1% of students appeared for examination whichever is less. The ranks shall be declared on the basis of the aggregate marks of all the four semesters taken together, provided the candidates has passed in all these four semesters in first attempt only.

OMB 10 SPECIALISATION OF STREAMS

OMB 10.1 A student may opt for any one of the specialization streams.

OMB 10.2 Every student shall be required to take four papers in the specialization stream in the third semester and four in the fourth semester.

OMB 11 REJECTION OF RESULTS

OMB 11.1 A candidate may at his / her desire reject his / her latest semester results of University Examination with respect to all subjects of that particular semester examination. Rejection of result of individual subjects shall not be permitted. Rejection shall be permitted only once during the entire course. Provided that earlier sessional marks of the rejected semester shall be retained. Provided further that in 4th semester the rejection shall not include Internship Work.

If the rejection of the University examination results of the semester happens to be of an odd semester, the candidate can take admission to the immediate next even semester. However, if the rejection of the University result is of even semester, the candidate cannot take admission to the next odd semester.

OMB 11.2 Application for rejection shall be submitted to the Registrar (Evaluation) of the University, through the Principal of the college, within thirty days from the date of announcement of results.

OMB 11.3 A candidate, who opts for rejection is eligible for the award of class and distinction, but is not eligible for the award of ranks.

Note: Guidelines on Practical components:

The objective of Practical components is to make the students understand how theory is applied in business. This should help the students to develop their skills required to become industry ready. Practical component mentioned under each subject are only indicative. Faculty may adopt any other relevant practical tasks / activities focusing on practical application of the theory.

Important: Questions should not be set from practical components area in the University theory examination of the concerned subject.

**SCHEME OF TEACHING AND EXAMINATION
MASTER OF BUSINESS ADMINISTRATION**

I SEMESTER

Subject code	Title of the Subject	Teaching hours / week			Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment	Total		IA	Exam.	
12MBA11	Managing Organizations	4	1	5	3	50	100	150
12MBA12	Managerial Economics	4	1	5	3	50	100	150
12MBA13	Quantitative Methods - I	4	1	5	3	50	100	150
12MBA14	Accounting for Management	4	1	5	3	50	100	150
12MBA15	IT for Managers	4	1	5	3	50	100	150
12MBA16	Managerial Communication	4	1	5	3	50	100	150
Total		24	6	30	18	300	600	900

II SEMESTER

Subject code	Title of the Subject	Teaching hours / week			Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment	Total		IA	Exam.	
12MBA21	Business, Government and Society	4	1	5	3	50	100	150
12MBA22	Quantitative Methods – II	4	1	5	3	50	100	150
12MBA23	Macro Business Environment	4	1	5	3	50	100	150
12MBA24	Marketing Management	4	1	5	3	50	100	150
12MBA25	Financial Management	4	1	5	3	50	100	150
12MBA26	Human Resource Management	4	1	5	3	50	100	150
Total		24	6	30	18	300	600	900

III SEMESTER

Subject code	Title of the Subject	Teaching hours/week			Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical/Field Work/Assignment	Total		IA	Exam.	
12MBA31	Strategic Management	4	1	5	3	50	100	150
12MBA32	Operations Management	4	1	5	3	50	100	150
	ELECTIVE 1	4	1	5	3	50	100	150
	ELECTIVE 2	4	1	5	3	50	100	150
	ELECTIVE 3	4	1	5	3	50	100	150
	ELECTIVE 4	4	1	5	3	50	100	150
Total		24	6	30	18	300	600	900

MARKETING AREA		FINANCE AREA		BANKING & INSURANCE AREA	
Sub Code	Subject	Sub Code	Subject	Sub Code	Subject
12MBA MM311	Business Marketing	12MBA FM321	Advanced Financial Management	12MBABI 331	Principles & Practices of Banking & Insurance
12MBA MM312	Sales & Retail Management	12MBA FM322/ 12MBA BI332	Investment Management	12MBABI 332/12M BAFM322	Investment Management
12MBA MM313	Consumer Behavior	12MBA FM323/ 12MBA BI333	Banking & Financial Services	12MBABI 333/12M BAFM323	Banking & Financial Services
12MBA MM314	Services Marketing	12MBA FM324	Cost Management	12MBABI 334	Banking & Insurance Products

HUMAN RESOURCE AREA

Sub Code	Subject
12MBAHR341	Recruitment & Selection
12MBAHR342	Compensation & Benefits
12MBAHR343	Learning & Development
12MBAHR344	Labour Law & Employee Relations

CREATIVE MANAGEMENT AREA

Sub Code	Subject
12MBACM351	Ideation, Brands and Business
12MBACM352	Engagement Planning and New Media
12MBACM353	Project Management and Budgeting
12MBACM354	Market Research and Insights

IV SEMESTER

Subject code	Title of the Subject	Teaching hours/week			Duration of Exam in Hours	Marks for			Total Marks
		Lecture	Practical/Field Work/Assignment	Total		IA	Exam./Viva Voce	External Assessment	
12MBA41	Supply chain Management	4	1	5	3	50	100		150
12MBA42	Total Quality Management	4	1	5	3	50	100		150
	ELECTIVE 5	4	1	5	3	50	100		150
	ELECTIVE 6	4	1	5	3	50	100		150
	ELECTIVE 7	4	1	5	3	50	100		150
	ELECTIVE 8	4	1	5	3	50	100		150
12MBA47	Internship	-	-		-	100	100	100	300
	Total	24	6	30	18	400	700	100	1200

MARKETING AREA**FINANCE AREA****BANKING & INSURANCE AREA**

Sub Code	Subject		Sub Code	Subject		Sub Code	Subject
12MBAM M415	Rural Marketing		12MBAFM 425	Project Appraisal Planning & Control		12MBABI4 35	Treasury & Risk Management
12MBAM M416	Strategic Brand Management		12MBAFM 426/ 12MBABI4 36	International Financial Management		12MBABI4 36/ 12MBAFM 426	International Financial Management
12MBAM M417	Integrated Marketing Communications		12MBAFM 427	Risk Management		12MBABI4 37	Legal Aspects of Banking & Insurance
12MBAM M418	International Marketing Management		12MBAFM 428	Tax Management		12MBABI4 38	Strategic Credit Management

HUMAN RESOURCE AREA**CREATIVE MANAGEMENT AREA**

Sub Code	Subject	Sub Code	Subject
12MBAHR445	International Human Resource Management	12MBACM455	Modern Retail and Private Brands
12MBAHR446	Personal Growth & Interpersonal Effectiveness	12MBACM456	Future of Brands and Business
12MBAHR447	Organization Development & Change	12MBACM457	Leadership and its Practice
12MBAHR448	Strategic Talent Management	12MBACM458	Branded Content and the Future of Media

SEMESTER I

MANAGING ORGANIZATIONS

Sub Code : 12MBA11	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Part A- Principles of Management

Module I : Introduction (6 Hours)

Management: Introduction, definition of management, nature, purpose and functions, levels and types of managers, managerial roles, skills for managers, evolution of management thought, Fayol's fourteen principles of management and recent trends in management.

Module II: Planning and organizing (12 Hours)

Planning: Nature of planning, planning process, objectives, MBO, strategies, level of strategies, policies, methods and programs, planning premises, decision making, process of decision making, types of decisions, techniques in decision making.

Organizing: Organization structure, formal and informal organizations, principles of organizations-chain of command, span of control, delegation, decentralization, empowerment.

Functional, divisional, geographical, customer based and matrix organizations, team based structures, virtual organizations, boundary less organizations.

Module III: Controlling (4 Hours)

Controlling, importance of controlling, controlling process, types of control, factors influencing control effectiveness.

Recommended Books

1. Essentials of Management-Koontz, 8/e, McGraw Hill
2. Management: Text and Cases-VSP Rao, Excel Books
3. MGMT, An Innovative approach to teaching and learning Principles of Management, Chuck Williams, Cengage Publications, 2010
4. Principles and practices of Management, Kiran Nerkar, Vilas Chopde, Dreamtech Press, 2011
5. Management Theory & practice – Chandan J. S, Vikas Publishing House.
6. Management Theory & Practice Text & Cases – Subba Rao P & Hima Bindu, Himalaya Publication.

Part B- Organizational Behaviour

Module IV: Introduction

(4 hours)

Organizational Behaviour: Introduction, definition, historical development, fundamental principles of OB, contributing disciplines, challenges and opportunities.

Module V: Foundations of Individual Behaviour

(14 Hours)

Individual behaviour: Foundations of individual behavior.

Ability: Intellectual abilities, Physical ability, the role of disabilities.

Personality: Meaning, formation, determinants, traits of personality, Big five and MBTI, personality attributes influencing OB.

Attitude: Formation, components of attitudes, relation between attitude and behaviour.

Perception: Process of perception, factors influencing perception, link between perception and individual decision making.

Emotions: Affect, mood and emotion and their significance, basic emotions, emotional intelligence, self awareness, self management, social awareness, relationship management.

Module VI: Motivation and Leadership (8 Hours)

Motivation: Meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories.

Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories-Fiedler's model, SLT, transactional and transformation leadership.

Module VII: Group Behaviour (4 Hours)

Definition, types, formation of groups, building effective teams.

Conflict: Meaning, nature, types, process of conflict, conflict resolution.

Power and politics: Basis of power, effectiveness of power tactics. The ethics of behaving politically.

Module VIII: Organizational culture (4 Hours)

Importance, managing culture. Work stress and its management.

Practical Component

- Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied in Module 2 and justifying why such structures are chosen by those organizations.
- Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities and behaviours with respects to the trait, behavioural and contingency theories studied.
- Identifying any five job profiles and listing the various types abilities required for those jobs and also the personality traits/attributes required for the jobs identified.

Note: Faculty can either identify the organizations/ leaders/jobs or students can be allowed to choose the same.

RECOMMENDED BOOKS:

1. Organizational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, Pearson, 14th Edition, 2012.
2. Introduction to Organisational Behaviour – Michael Butler, Jaico Publishing House,
3. Organization Behaviour – Ashwathappa, Himalaya Publication House
4. ORGB - Nelson, Quick, Khanelwal, 2/e, Cengage Learning, 2012.
5. Organizational behaviour - Anada Das Gupta, Biztantra, 2011.
6. Organizational behaviour: A modern approach - Arun Kumar and Meenakshi, Vikas Publishing House, 2011.
7. Organizational behaviour – Rao V. S. P, Excel Books, 2009.

REFERENCE BOOKS:

1. Organizational Behaviour - Fred Luthans, 12/e, Mc-Graw Hill International, 2011.
2. Management and organizational Behaviour - Laurie J Mullins, Pearson education
3. Fundamentals of organizational behaviour - Slocum/Hillriegel. Cengage Learning
4. Organizational Behaviour - Aquinas P. G, Excel Books.

MANAGERIAL ECONOMICS

Sub Code : 12MBA12	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: Introduction to Economic (8 Hours)
Managerial Economics: Meaning, Nature, Scope, & Significance. Uses of Managerial Economics. Role and Responsibilities of Managerial Economist. Relationship of Managerial Economics with Statistics, Accounting and Operations Research. The Basic process of decision making.

Module II: Fundamental Concepts of Managerial Economics (6 Hours)
Opportunity Costs, Incremental Principle, Time perspective, Discounting and Equi-Marginal principles.

Theory of the Firm: Firm and Industry, Forms of Ownership, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol's Model, Marris's Hypothesis, Williamson's Model. Behavioural theories: Simon's Satisficing Model, Cyert and March Model. Agency theory.

Module III: Demand analysis (10 Hours)

Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand – Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Elasticity of supply. Demand forecasting: Meaning & Significance, Methods of demand forecasting. **(No problems)**

Note: Illustrative numerical examples to be used to explain the concepts.

Module IV: Cost Analysis (6 Hours)

Concepts, Types of cost, Cost curves, Cost – Output Relationship in the short run and in the long run, LAC curve.

Module V: Production analysis (8 Hours)

Concepts, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale. Indifference Curves, ISO-Quants & ISO-Cost line. Economies of scale, Diseconomies of scale.

Module VI: Market structure and pricing practices: (8 Hours)

Perfect Competition, Features, Determination of price under perfect competition.

Monopoly: Features, Pricing under monopoly. Price Discrimination.

Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation.

Oligopoly: Features, Kinked demand Curve, Cartels, Price leadership.

Module VII Descriptive Pricing Approaches (4 hours)

Full cost pricing, Product line pricing, Product life cycle pricing.

Pricing Strategies: Price Skimming, Penetration Pricing, Loss leader pricing, Peak Load pricing.

Module VIII: Profits (6 Hours)

Determinants of Short-term & Long-term profits. Classification – Measurement of Profit. Break Even Analysis – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions.

Practical Components:

- Assessment of Impact of advertisement or sales promotion on the demand of a product (Preferably FMCG goods)
- Study of demand elasticity for a product when there is a price increase or price decrease.
- Market surveys/ consumer intention survey for an existing or a new product/service.
- Opinion polls to understand the buyer behavior for a product or a service.
- Demand forecasting – Mini project may be given to students to assess the demand for a product or a service using any method.
- Preparing a project proposal for a new business venture to understand the BEP using real time data.
- Exploring application and usage of econometric models by using appropriate software packages.

RECOMMENDED BOOKS:

1. Managerial Economics –D M Mithani, 5/e, Himalaya Publication. 2011.
2. Managerial Economics – D N Dwivedi, 7/e, Vikas Publication. 2008
3. Managerial Economics – Geethika, Ghosh&Choudhury, 2/e, McGraw Hill. 2011
4. Managerial Economics – Dominick Salvatore, 6/e, Oxford Publishers, 2010.
5. Managerial Economics - Craig H Petersen, W. Chris Lewis & Sudhir K Jain, 4/e, Pearson Education, 2006.
6. Managerial Economics: Analysis, Problems and Cases – Truet & Truet, 8/e, Wiley, 2009.

REFERENCE BOOKS:

1. Managerial Economics-Atmanand, 2/e, Excel Books, 2010.
2. Managerial Economics-Allen, Weisgelt, Doherty and Mansfield, 7/e,Viva, 2010.
3. Managerial Economics – Yogeshmaheswari, 2/e,PHI, 2011
4. Managerial Economics – Samuelson & Marks, 5/e, Wiley, 2009.
5. Managerial Economics – Keating & Wilson, 2/e, Biztantra, 2009.
6. Managerial Economics – Hirschey, 2/e, Cengage Learning, 2010.
7. Managerial Economics: Case Study solutions – Kaushal H, 1/e, Macmillan, 2011.
8. Managerial Economics – Nadar & Vijayan, 2/e, PHI, 2010.

QUANTITATIVE METHODS : I

Sub Code : 12MBA13	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: Business Research (6 Hours)

An overview: Research process and Types of Research, problem formulation, management problem v/s. research problem, .Approaches to Research, Importance of literature review.

Business Research Design: Steps involved in a research design.

Exploratory research: Meaning, suitability, collection.

Descriptive research: Meaning, types of descriptive studies, data collection methods

Causal research: Meaning, various types of experimental designs, types of errors affecting research design.

Analytical research: Introduction to analytical research.

Module II: Sampling and Data Collection (8 Hours)

Sampling and sampling distribution: Meaning, Steps in Sampling process, Types of Sampling - Probability and non probability Sampling Techniques.

Data collection: Primary and Secondary data – Sources – advantages/disadvantages.

Data collection Methods: Observations, Survey, Interview and Questionnaire design, Qualitative Techniques of data collection.

Module III: Measurement & Scaling Techniques (6 hours)

Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Criteria for good measurement, attitude measurement – Likert's Scale, Semantic Differential Scale, Thurstone-equal appearing interval scale. (Theory Only)

Module IV: Descriptive statistics (6 hours)

Measures of central tendency: Average: Concept, Types – Mathematical Averages: Arithmetic Mean, Median, Mode (No grouping table method). Partition Values: Quartiles, Deciles and Percentiles - Comparison of the Various Measures of Central Tendencies.

Module V: (6 Hours)

Measures of Dispersion: Standard Deviation – Variance – Coefficient of Variance, Skewness: Relative measures of skewness- Karl- Pearson Co-efficient of skewness.

Correlation and regression: Scatter Diagram, Karl Pearson's coefficient of Correlation (One way table only), Rank Correlation, Concurrent Deviation - Regression: Method of Least Squares,

Module VI: Inferential Statistics (8 Hours)

Probability: Concept and Definition - Relevance to Management Decisions - Sample Space and Events - Relevance of Permutations and Combinations to Probability - Rules of Probability, Random Variables and Concept of Probability Distribution. Theoretical Probability Distributions: Binomial, Poisson and Normal and problems on it. Baye's Theorem (No derivation)

Module VII: Hypothesis (10 Hours)

Formulation of hypothesis, Testing of hypothesis and inferences: Procedure of testing hypothesis, Type I and Type II Errors.

Parametric tests: Z-Test, t-test, F-test, Analysis of Variance – One-Way and Two-way classification.

Module VIII: Non parametric tests (6 Hours)

Chi-Square test (Problems), Multivariate analysis (Theory only). Report writing

Practical Components:

Students are expected to Find the following parameters or Prepare for a given dataset using MS Excel and SPSS.

- Draw all types of Diagrams and Graphs
- Construction of one way and two way tables
- Arithmetic Mean
- Geometric Mean
- Harmonic Mean
- Median, Mode
- Quartiles, Deciles, Percentiles
- Minimum, Maximum, Range
- Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variance
- Co-efficient of Skewness: - Karl- Pearson, Bowley, Kelly,
- Correlation coefficient
- Regression coefficient – Slope (b in $y = a + bx$)
- Regression Constant – Intercept (a in $y = a + bx$)
- Z-Test, t-test, F-test Values
- Chi-Square test Values
- Analysis of Variance (ANOVA) Values
- Research Proposal writing
- Data Interpretation and report writing: Short and Long reports: Report presentation methods, ex: Power Point Presentation, etc

RECOMMENDED BOOKS:

1. Fundamentals of Statistics, S. C. Gupta, Himalaya Publishing House, 7/e, 2012.
2. Research Methodology: Concepts and Cases – Deepak Chawla & Neena Sondhi, Vikas, 2011
3. Marketing Research by Naresh K. Malhotra, Pearson publishers, 2012
4. Business Research Methods–Donald R. Cooper & Pamela S Schindler, 9/e, TMH,2007.
5. Statistics for Business and Economics - Anderson, Sweeney, William, 11/e, Cengage Learning, 2012.
6. Methodology of Research in Social Sciences – Krishnaswami O. R, Ranganatham M, HPH, 2007.
7. Statistics for Management, Levin and Rubin

8. Research Methods for Business, Uma Sekaran, Wiley India, 5/e,2011.

REFERENCE BOOKS:

1. Statistical Methods - Gupta S. P, Sultan Chand & Sons, 2002.
2. Complete Business Statistics - Aczel & Sounderpandian, 7/e, Tata-McGraw Hill, 2006.
3. Research Methodology- Kothari C. R, 2/e,Vishwa Prakashan, 2002.
4. Statistical Tools for Managers – Apte D. P, Excel Books, 2009.

ACCOUNTING FOR MANAGEMENT

Sub Code : 12MBA14	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	
Ratio of Theory to problems = 40:60	

Module I: Introduction to Accounting (4 Hours)

Need and Types of Accounting, Users of Accounting, concepts and conventions of Accounting, Accounting Equations.

Module II: Preparation of Books of Accounts (10 Hours)

Journals, Subsidiary books, three column cash book, ledgers and trial balance. (Problems only on three column cash book)

Module III: Preparation of Financial Statements (12 Hours)

Preparation of final accounts of sole traders and companies (excluding partnership) in horizontal format (students are to be introduced to vertical formats also)

Module IV: Analysis of Financial Statements (14 Hours)

Comparative, common size and trend analysis, Ratio Analysis, Preparation of financial statements using ratios, Cash flow Statement.

Module V: Accounting Standards and IFRS (4 Hours)

IFRS and proposed changes in Indian Accounting Standards.

Module VI: Audit Report (4 Hours)
Audit Report, Directors' Report and basics of MAOCARO 1998 (Amended 2003)

Module VII: (2 Hours)
Corporate Governance, Human Resource Accounting, Forensic Accounting
Window Dressing

Module VIII: Income Tax (6 Hours)
Heads of Income, Salary, Profit in lieu of salary, Perquisites, deductions u/s 80C, Income Tax Rates – For Individuals only (Only Theory)

Practical Components:

- Collecting Annual reports of the companies and analyzing the financial statements using different techniques and presenting the same in the class.
- Analyzing the companies' cash flow statements and presenting the same in the class.
- Exposing the students to usage of accounting software's (Preferably Tally)
- Filling up of ITR forms

RECOMMENDED BOOKS:

1. Financial Accounting: A Managerial Perspective - Narayanaswamy R, 4/e ,PHI, 2011 (Based on IFRS).
2. Accounting For Managers – Jawaralal, 5/e, Himalaya Publishing House, 2011.
3. Financial Accounting – Dhanesh K. Khatri, – McGraw Hill, 2011
4. A Text book of Accounting For Management – Maheswari S. N, Maheswari Sharad K. Maheswari, 2/e, Vikas Publishing house (P) Ltd.
5. Financial Accounting For Management-Ramachandran N & Ram Kumar Kakani, 3/e TMH Publications, 2011.
6. Financial Accounting - Tulsian P. C, 1/e, Pearson Education.
7. Accounting for managers –Madegowda J, Himalaya Publishing House.
8. Advanced Accountancy- Gupta R. L & Radhaswamy M–Sultan Chand Publications
9. Financial Accounting - Jain and Narang, Kalyani Publishers
10. Direct Taxes – Vinod Singhanian and Kapil Singhanian, Taxman Publications

REFERENCE BOOKS:

1. Financial Accounting for Management: An Analytical Perspective – Ambrish Gupta, 1/e, Pearson Education.
2. Introduction to Financial Statement Analysis – Ashish K Bhatta charya, Elsevier India
3. Accounting for Managers: Text & Cases - Bhattacharya, 3/e, Vikas Publications, 2004.
4. Financial Accounting for Business Managers - Ashish K. Bhattacharya, 2/e, PHI, 2005.
5. Financial Accounting – Raman B. S, Vol I & Vol II, United Publishers,1/e, 2009.
6. Financial Accounting (IFRS update)– Gary A. Porter & Curtis L. Norton, 6/e, Cengage Learning.
7. Accounting For Business Managers – Sakshi Vasudeva, Himalaya Publishing House.
8. Accounting For Management – Arora M. N., Himalaya Publishing House.
9. Essentials of Financial Accounting – Bhattacharya, 2/e, Prentice Hall India, (Based on IFRS)
10. Comdex (Computer and Financial Accounting with Tally 9.0 Course Kit). - Dream Tech.
11. Comdex – Tally 9, Namrata Agrawal- DreamTech.
12. IFRS: A Practical approach – Jasmine Kaur, McGraw Hill.
13. Income Tax - Gaur & Narang, Kalyani Publishers.
14. Financial Accounting - Paul Kimmet, Jerry Weygant & Donald Kieso - Wiley Publications.

IT FOR MANAGERS

Sub Code : 12MBA15	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: Foundation concepts**(8Hours)**

Foundations of information systems (IS) in business: Data & Information, Information as a Resource, Information in organizational Functions, System

concepts – Components of an IS – IS resources – Fundamental roles of IS applications in business – Trends in IS.

Module II: Kinds of Information Systems (8Hours)

TPS, OAS, MIS, DSS, GDSS, ES, EIS or ESS, Parameters for selecting a suitable Information System.

Module III: Building and Managing Systems (8Hours)

System Analysis and Design – Systems Development Life Cycle – System Building Approaches – Prototyping – Rapid Application Development Models.

Module IV: Business value of telecommunication networks (6 Hours)

The basics of doing business on the Internet- the Internet revolution – the business value of Internet, Intranet and Extranet.

Module V: Business applications (6 Hours)

IT in business: functional business systems – cross-functional enterprise systems – Enterprise resource planning (ERP)- Customer relationship management (CRM) and Supply chain management (SCM).

Module VI: e-Business and e-Commerce (6 Hours)

E-Business systems: e-Business models – Enterprise e-Business systems –E-Commerce systems – Essential e-Commerce processes – electronic payment processes – e-commerce application trends – Web store requirements.

Module VII: Organization & Information Technology (7 Hours)

IT Capabilities and their organizational impact Fundamentals of strategic advantage — using IT for strategic advantages.

Module VIII: Management challenges (7 Hours)

Management Issues in MIS: Information Security and Control – Quality Assurance -Ethical and Social Dimensions – Intellectual Property Rights as related to IT Services / IT Products – Managing Global Information Systems

Practical Components :

Lab Sessions relating to

- MS Word
- Developing business presentation with MS-PowerPoint
- MS Excel up to Lookups

RECOMMENDED BOOKS:

1. Management Information Systems: Managing the Digital Firm - Loudon, Kenneth C., and Jane P. Loudon. 10/e, Prentice-Hall, 2007.
2. Management Information Systems: Text & Cases – Jawadekar W. S, 4/e, Tata McGraw Hill, 2010.
3. Computer Application in Business – Sudalaimuthu, Anthony Raj, HPH.
4. MIS Managing Information Systems in Business, Government and Society - Rahul De ,1/e, Wiley India, 2012.
5. Information Technology for Management: Transforming Organizations in the Digital Economy - Efraim Turban, & Linda Volonino. 7/e, Wiley India. 2007.
6. Management Information Systems – Nirmalya bagchi, Vikas Publishing House, 2011.

REFERENCE BOOKS:

1. Computer Applications in Management - Niranjan Shrivastava. Dreamtech Press, 2011.
2. Business Driven Technology - Haag, Baltzan, & Philips. 2/e, Tata McGraw-Hill, 2009.
3. Fundamentals of Information Technology - Alexis Leon, & Mathews Leon , 2/e, Vikas, 2009.

Website:

<http://www.fundula.com/allcourses>

MANAGERIAL COMMUNICATION

Sub Code	: 12MBA16	IA Marks	: 50
No. of Lecture Hrs /week	: 04	Exam Hrs.	: 03
Total No. of Lecture Hrs.	: 56	Exam Marks	: 100
Practical Component : 01 Hr/ Week			

Module I: Introduction**(6Hours)**

Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication – Importance of communication in management – Communication structure in organization – Communication in conflict resolution - Communication in

crisis. Communication and negotiation. Communication in a cross-cultural setting

Module II: Oral Communication (6Hours)

Meaning – Principles of successful oral communication – Barriers to communication – Conversation control – Reflection and Empathy: two sides of effective oral communication. Modes of Oral Communication.

Listening as a Communication Skill, Non verbal communication.

Module III: Written Communication (6Hours)

Purpose of writing – Clarity in writing – Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features – Coherence – Electronic writing process.

Module IV: Business Letters and Reports (8Hours)

Introduction to business letters – Types of Business Letters - Writing routine and persuasive letters – Positive and Negative messages

Writing Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, Short and Long reports

Writing Proposals: Structure & preparation.

Writing memos

Module V: Case Method of Learning (8Hours)

Understanding the case method of learning – Different types of cases – Difficulties and overcoming the difficulties of the case method – Reading a case properly (previewing, skimming, reading, scanning) – Case analysis approaches (Systems, Behavioural, Decision, Strategy) – Analyzing the case – Dos and don'ts for case preparation – Discussing and Presenting a Case Study

Module VI (6Hours)

Presentation skills: What is a presentation – Elements of presentation – Designing & Delivering Business Presentations – Advanced Visual Support for Managers

Negotiation skills: What is negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies

Module VII**(6Hours)****Employment communication:** Introduction – Composing Application Messages - Writing CVs – Group discussions – Interview skills**Impact of Technological Advancement on Business Communication –** Technology-enabled Communication - **Communication networks** – Intranet – Internet – e mails – SMS – teleconferencing – videoconferencing**Module VIII: Group Communication****(10Hours)**

Meetings – Planning meetings – objectives – participants – timing – venue of meetings – leading meetings. Meeting Documentation: Notice, Agenda, Resolution & Minutes.

Seminars – workshop – conferences**Media management** – The press release – Press conference – Media interviews**Etiquette Advantage in Business Communication****Practical Components:**

- Demonstrate the effect of noise as a barrier to communication
- Make students enact and analyze the non-verbal cues
- Give exercises for clarity and conciseness in written communication.
- Group Activity: Form Student groups and ask them to write a persuasive letter and proposal for an innovative product or service. Circulate the work from each group among all other groups and ask them to evaluate the letter and proposal in line with possible responses to a letter (pleased, displeased, neither pleased nor displeased but interested, not interested)
- A suitable case is to be selected and administered in the class sticking to all the guidelines of case administering and analysis. Demonstrate using Communication Equipments like Fax, Telex, Intercoms, etc,
- Demonstrating Video conferencing & teleconferencing in the class.
- Conduct a mock meeting of students in the class identifying an issue of their concern. The students should prepare notice, agenda and minutes of the meeting.

- Business etiquettes to be demonstrated in role play by students
- Each student to give presentation of 5 minutes (this can be spread throughout the semester) and to be evaluated by the faculty

RECOMMENDED BOOKS:

1. Business Communication : Concepts, Cases And Applications – Chaturvedi P. D, & Mukesh Chaturvedi ,2/e, Pearson Education, 2011 (Module 1, 2, 4, 5, & 7).
2. Business Communication: Process And Product – Mary Ellen Guffey, 3/e, Cengage Learning, 2002. (Module 3)
3. Communication – Rayudu C. S, HPH.
4. Business Communication – Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010 (Module 1, 2, 4, 5, & 7).
5. Advanced Business Communication – Penrose, Rasberry, Myers, 5/e, Cengage Learning, 2004 (Module 1, 5, 6 & 8).
6. BCOM – Lehman, DuFrene, Sinha, Cengage Learning, 2/e 2012
7. Business Communication – Madhukar R. K, 2/e, Vikas Publishing House.

REFERENCE BOOKS:

1. Effective Technical Communication - Ashraf Rizvi M, TMH, 2005.
2. Business Communication - Sehgal M. K & Khetrapal V, Excel Books.
3. Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.
4. Basic Business Communication – Raj Kumar, Excel Books, 2010.

Website:

<http://www.fundula.com/allcourses>

SEMESTER II

BUSINESS, GOVERNMENT AND SOCIETY

Sub Code: 12MBA21	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: The Study of Business, Government and Society (BGS)
(4 Hours)

Importance of BGS to Managers – Models of BGS relationships – Market Capitalism Model, Dominance Model, Countervailing Forces Model and Stakeholder Model – Global perspective – Historical Perspective

Module II: The Dynamic Environment **(4 Hours)**

Historical Forces changing the Business Environment – Key environments of Business – Power dimensions of Business – Theoretical perspective – Sociological perspective

Module III: Corporate Governance **(8 Hours)**

Introduction, Definition, Market model and control model, OECD on corporate governance, A historical perspective of corporate governance, Issues in corporate governance, relevance of corporate governance, need and importance of corporate governance, benefits of good corporate governance, the concept of corporate, the concept of governance, theoretical basis for corporate governance, obligation to society, obligation to investors, obligation to employees, obligation to customers, managerial obligation, Indian cases

Module IV: Public Policies **(8 Hours)**

The role of public policies in governing business, Government and public policy, classification of public policy, areas of public policy, need for public policy in business, levels of public policy, elements of public policy, the corporation and public policy, framing of public policy, business and politics- levels of involvement, business, government, society and media relationship

government regulations in business, justification of regulation, types of regulation, problems of regulation

Module V: Environmental concerns and corporations (6 Hours)

History of environmentalism, environmental preservation-role of stakeholders, international issues, sustainable development, costs and benefits of environmental regulation, industrial pollution, role of corporate in environmental management, waste management and pollution control, key strategies for prevention of pollution, environmental audit, Laws governing environment

Module VI: Business Ethics (6 Hours)

Meaning of ethics, business ethics, relation between ethics and business ethics, evolution of business ethics, nature of business ethics, scope, need and purpose, importance, approaches to business ethics, sources of ethical knowledge for business roots of unethical behavior, ethical decision making, some unethical issues, benefits from managing ethics at workplace, ethical organizations

Module VII: Corporate Social Responsibility (6 Hours)

Types and nature of social responsibilities, CSR principles and strategies, models of CSR, Best practices of CSR, Need of CSR, Arguments for and against CSR, CSR Indian perspective, Indian examples

Module VIII: Business Law (14 Hours)

Law of contract, meaning of contract, agreement, essential elements of a valid contract, classification of contracts, proposal and acceptance, free consent, void agreements

Negotiable instruments act 1881: Nature and Characteristics of Negotiable instruments, Kinds of Negotiable Instruments – Promissory Notes, Bills of Exchange and Cheques. Parties to Negotiable Instruments, Negotiation, Presentment, Discharge and Dishonor of Negotiable Instrument, Law of agency, Bailment & Pledge:

Sale of goods act 1930: Definition of Sale, Sale v/s Agreement to Sell, Goods, price and Time, Condition and Warranties, Express and Implied Condition, “Doctrine of Caveat Emptor”, Performance of Contract of sale, Right of Unpaid Seller.

Intellectual property law, law relating to patents, law relating to copyrights, law relating to trade mark

Practical Component:

- Students are expected to study any five CSR initiatives by Indian organizations and submit a report for the same.
- A group assignment on “The relationship between Business, Government and Society in Indian Context and relating the same with respect the models studied in module 1.
- Case studies/Role plays related ethical issues in business with respect to Indian context.

RECOMMENDED BOOKS:

1. Business, Government, and Society: A Managerial Perspective, Text and Cases – John F. Steiner, 12/e, McGraw-Hill, 2011.
2. Business and Government – Francis Cherunilam, HPH.
3. Corporate Governance: principles, policies and practices – Fernando A. C, 2/e, Pearson, 2011.
4. Business Ethics and Corporate Governance - Ghosh B. N, Tata McGraw-Hill, 2012.
5. Business Law for Managers, Goel P. K, Biztantra, 2012.
6. Corporate Social Responsibility: A Study of CSR Practices in Indian Industry, Baxi C. V & Rupamanjari Sinha Ray, Vikas Publishing House, 2012.

REFERENCE BOOKS:

1. Business and Society - Lawrence and Weber, 12/e, Tata McGraw-Hill, 2010.
2. Business Ethics - Bajaj P. S & Raj Agarwal, Biztantra, 2012.
3. Corporate Governance - Keshoo Prasad, 2/e, PHI.
4. Corporate Governance, Ethics and social responsibility - Balachandran V, & Chandrashekharan V, 2/e, PHI, 2011.
5. Corporate Governance – Machiraju H. R, HPH.
6. Business Ethics and Corporate Governance – Prabakaran S, Excel Books.
7. Corporate Governance – Badi N. V, Vrinda Publications, 2012.
8. Civic Sense – Prakash Pillappa, Excel Books, 2012.

QUANTITATIVE METHODS- II

Sub Cod : 12MBA22	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)

Introduction to Operations Research. Definition, scope of Operations Research, characteristics, advantages and limitations. Quantitative approach to decision making, models & modeling in Operations Research.

Module II (8 Hours)

Linear programming, Structure of linear program model, Assumption, Advantages, Limitations, General mathematical model, Guidelines for formulation of linear programming model, graphical method, algorithm (Only illustrative problems) Duality in linear programming..

Module III (8 Hours)

Transportation problem, General structure of transportation problem, methods of finding initial basic feasible solution (NWCM, LCM & VAM), test for optimality (MODI Method), degeneracy (theory only), Assignment problems, Introduction, General structure. problems on minimization & maximization

Module IV (8 Hours)

Decision theory – decision under uncertainty- Maxmin & Minmax, decision under Risk- Expected Value, decision tree problems.

Job Sequencing- N Jobs-two machines and N Jobs-three machines, 2 jobs-M machines cases.

Module V**(8 Hours)**

Theory of games- formulation of game models, Two person Zero sum games & their solution, $2 \times N$ and $M \times 2$ games, pure strategy games with saddle point, Mixed strategies (Graphical and algebraic methods), Limitations of game theory.

Module VI**(6 Hours)**

Simulation, process of simulation, types of simulation, steps in simulation process, Monte Carlo simulation, application in queuing, inventory, finance, marketing and HR areas, Advantages & Disadvantages .

Module VII**(4 Hours)**

Queuing theory, General structure of queuing system, Operating characteristics of queuing system, Queuing models (Problems on M/M/1)

Module VIII**(8 Hours)**

Project management, Structure of projects ,phases of project management-planning, scheduling, controlling phase, work break down structure, project control charts, network planning, PERT & CPM ,Network components & precedence relationships, critical path analysis, probability in PERT analysis, theory of crashing.

Practical Components:

- Solving and analyzing theoretical problems by using software packages like excel- data analysis, TORA and MS-Project.

RECOMMENDED BOOKS:

1. Operations Research: Theory, Methods and Applications - Sharma S. D, Kedar Nath, Ram Nath & Co.
2. Operations Research : An Introduction - Taha H. A, 9/e, PHI

3. Operations Research: Theory and Applications - Sharma J. K, 4/e , Macmilan, 2010
4. Operations Research - Vohra N. D, 4/e, TMH, 2010.
5. Operations Research – Anand Sharma, HPH.

REFERENCE BOOKS:

1. Quantitative Methods for Business - Anderson Sweeney, Williams, 10th edition, Cengage, 2011
2. Introduction to Operations Research - Frederick S. Hillier, Gerald J. Lieberman, 9/e, Tata McGraw-Hill, 2011.
3. Operations Research – Kalavathy S, 3/e, Vikas Publishing House.
4. Project Management - Samuel J. Mantel, Jr, Jack R. Meredith, Scott M. Shafer, Margrett M. Sutton with MR Gopalan, Wiley India, 2011.
5. An Introduction to Operations Research - Kothari C R, 3/e, Vikas Publishing House, 2011.
6. Operations Research – Anitha H. S, Excel Books, 2010.

MACRO BUSINESS ENVIRONMENT

Sub Code: 12MBA23	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(8 Hours)

Indian Economy and Business environment: Nature and Scope, Structure of the Business Environment – Internal and External environment.
 Political and Legal Environment: overview, Philosophies, Political System, Judiciary, Constitution of India.
 Economic Environment: overview, Nature of Indian Economy, Features of Indian Economy, Charges in recent times.
 Socio – Cultural Environment: Socio Cultural factors affecting the Business.

Module II

(8 Hours)

Globalisation and Indian Business Environment: Meaning and Implications, Phases, Globalisation Impact on Indian Economy across Sectors. Modes of entry strategies.

India's Foreign Trade Policies – Recent Developments, Global outsourcing, MNCs and FDI in Retail, Infrastructure, Pharma. Insurance, Banking & Finance and Automobile. Impact of WTO ON India's foreign trade. Technological Environment: Technology and Development, Integrating technology with Business. India and Global Knowledge Market.

Module III

(6 Hours)

International Business Environment: Review of the global economy, The global recession, Business environment in Developed and Developing Countries.

International trade theories.

GATT and WTO: Agreements and Implications.

International cultural aspects- Values and norms, religion and ethics, language, education, impact of cultural differences on business.

Module IV

(8 Hours)

Measuring the Economy: Basic economic Concepts, Open and Closed Economies, Primary, Secondary and Tertiary sectors and their contribution to the economy. SWOT Analysis for the Indian economy. Measuring GDP and GDP Growth rate. Components of GDP.

Business Cycle- Features, Phases, Economic Time series – Economic indicators, Correlation, persistence, coherence.

Inflation: Types, Measurement, Kinds of Price Indices.

Employment and unemployment rates: Measurement.

National Income: Estimates, Trends, Measurement, Problems in measuring National Income.

Module V

(8 Hours)

Industrial Policies and Structure: Planning- Problems in industrial development during the plan period, Classification of industries based on ownership. Industrial policies, Industrial strategy for the future, New industrial policy 1991.

Structure of Indian Industry: Public and Private Sector Enterprises, Objectives of PSUs, Performance and shortcomings. Private Sector– growth, problems and prospects. SSI – Role in Indian Economy. Disinvestments in Indian public sector Units since 1991.

Industry Analysis: Textiles, Electronics, Automobile, FMCG, Telecom, Pharma Sectors.

Module VI**(8 Hours)**

Economic policies: Privatisation-Problems and prospects.

Fiscal Policy: Objectives, Instruments, Union Budget, Reforms -Raja Chelliah Committee Recommendations, Taxes, Role of Government.

Monetary Policy: Money, Measures of money supply, Monetary system in India, Monetary policy- Tools for credit control. Structure of the Banking system, RBI and its functions, Banking structure reforms - Narasimham committee recommendations.

MODULE VII**(6 Hours)**

Infrastructure in the Indian Economy- Infrastructure and economic Development, Energy, Power, Transport system- Railways, Road transport, Water transport and Air Transport.Power.

Communication System in India, Development of IT Sector in India – its contributions to Indian economy.

Importance of Human resources development- Measures of Human development, Human Development index. Major thrust areas in human resource development.

Module VIII**(4 hours)**

Agriculture and Business: Role of Agriculture in Economic Development, Trends in Agricultural Production, Agro based Industries, Dependence of Business on Agriculture, Corporate India Initiatives.

Practical Component

- A Debate on 'Should the government allow cultivation of BT crops in India'.
- 'Indian Shining' a debate on for and against.
- International Cultural environment- The problems faced by MNC's – A Case study.
- 'Disinvestment in PSU's since 1991' - A case study
- Exposure of INR to the Fluctuation of USD and the impact on Indian companies receivables and payables.
- Tracking of business cycle for India using GDP data.
- A case study on Bangalore Metro Rail project.
- Corporate India initiatives for rural developments

RECOMMENDED BOOKS:

1. Economic Environment of Business – Misra S. K & Puri V. K. , 6/e, Himalaya publishing house, 2010.
2. Business Environment :Text and Cases - Justin Paul, 3/e, McGraw Hill, 2011.
3. Macro Economic Theory – Vaish M. C, 14/e, Vikas Publishing House, 2010
4. Business Environment - Fernando, 1/e, Pearson, 2011.
5. Indian Economy – Datt and Sundharam, 64th Edition, S Chand, 2011.
6. International Business: Competing in the Global Marketplace - Charles W. L. Hill & Jain, 6/e, TMH, 2009.

REFERENCE BOOKS:

1. Principles of Macro Economics –Mankiw, 4/e, Cengage Learning, 2011.
2. Macro Economics – Andrew. B. Abel, & Ben S. Bernanke, 7/e, Pearson Education, 2011.
3. Macro Economic Theory – Kennedy,1/e , PHI, 2011.
4. Macro Economics: Theory and Policy – Vanitha Agarwal, 1/e, Pearson, 2010.
5. Macro Economics- Hall & Papell, 6/e, Viva Books, 2010.
6. The Business Environment – Wetherly & Otter, 1/e, Oxford University Press, 2010.
7. Business Environment – Suresh Bedi, Excel Books.

Exam: Only Theory questions.

MARKETING MANAGEMENT

Sub Code: 12MBA24	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I**(7 Hours)**

Introduction: Nature and scope of marketing, Evolution, Various marketing orientations, Marketing Vs Selling concepts, Consumer need, Want and

demand concepts, Marketing Environment – Assessing the impact of micro and macro environment. Marketing challenges in the globalized economic scenario.

Module II

(7 Hours)

Understanding Consumer Behaviour: Buying motives, Factors influencing buying behaviour, Buying habits, Stages in consumer buying decision process, Types of consumer buying decisions, Organizational buying Vs House hold buying, Consumer Protection Act, 1986 – An Introduction.

Module III

(8 Hours)

Market Segmentation, Targeting, Positioning & Branding

Segmentation: Meaning, Factors influencing segmentation, Market Aggregation, Basis for segmentation, Segmentation of Consumer and Industrial markets.

Targeting: Meaning , Basis for identifying target customers, Target Market Strategies,

Positioning: Meaning, Product differentiation strategies, Tasks involved in positioning

Branding: Concept of Branding, Brand Types, Brand equity, Branding Strategies

Module IV

(7 Hours)

Product Decisions: Concept, product hierarchy, New product development, diffusion process, Product Life cycle, Product mix strategies and merchandise planning and strategies.

Packaging / Labeling: Packaging as a marketing tool, requirement of good packaging, Role of labeling in packaging

Module V

(4 Hours)

Pricing Decisions: Pricing concepts for establishing value, Pricing strategies-Value based, Cost based, Market based, Competitor based, New

product pricing – Price Skimming & Penetration pricing,

Module VI

(5 Hours)

Distribution Decisions: Meaning, Purpose, Channel alternatives, Factors affecting channel choice, Channel design and Channel management decisions, Channel conflict, Distribution system, Multilevel Marketing (Network Marketing)

Module VII

(9 Hours)

Integrated Marketing Communications: Concept of communication mix, communication objectives, steps in developing effective communication, Stages in designing message

Advertising: Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model, Advertising Agency Decisions

Sales Promotion: Sales Promotion Mix, Kinds of promotion, Tools and Techniques of sales promotion, Push-pull strategies of promotion.

Personal selling: Concept, Features, Functions, Steps/process involved in Personal Selling,

Publicity / Public Relation: Meaning, Objectives, Types, Functions of Public Relations

Direct Marketing: Meaning, Features, Functions, Basic concepts of e-commerce, e-business, e-marketing, m-Commerce, m-marketing, e-networking.

Module VIII

(5 Hours)

Marketing Planning: Meaning, Concepts of Marketing plan, Steps involved in planning.

Marketing Organisation: Factors influencing the size of the marketing organization, various types of marketing structures/organisation

Marketing Audit: Meaning, Features of marketing audit, various components of marketing audit.

CASE STUDIES ON INDIAN CONTEXT ONLY (4 Hours)

Practical Components:

- Consider a few products like mobile phone, shoes, clothes etc and analyse their buying motives.
- Analyse the various colleges in a city – how are they segmented? If you were to start a new MBA college, how would you position it? What would your parameters be?
- Analyse the product life cycle of a few common products like jeans, pagers, desktop computers etc etc.
- Go to a supermarket and study the pricing, packaging and advertising strategy of some FMCG companies like Levers, Godrej, ITC, Britannia, Parle, and others in some products like soaps, biscuits, juices etc.
- Take any consumer product like soaps, biscuits etc and study the marketing organization of the company producing it.

RECOMMENDED BOOKS:

1. Marketing Management: A South Asian Perspective - Kotler, Keller, Koshy & Jha, 13/e, Pearson Education, 2012.
2. Marketing : An Introduction - Rosalind Masterson & David Pickton, 2/e, Sage Publications, 2010.
3. Marketing Management - Tapan Panda, 2/e, Excel Publication, 2007.
4. Marketing Management - Ramaswamy V. S. & Namakumar S, 4/e, Macmillan Publishers, 2011.
5. Fundamentals of Marketing Management - Etzel M. J, B J Walker & William J. Stanton, 14/e, TMH, 2010.
6. Marketing Management - Arun Kumar & Meenakshi N, 2/e, Vikas, 2011.
7. Marketing Management – K Karunakaran, 3/e, 2012, Himalaya Publishing House,

REFERENCE BOOKS:

1. Marketing Management-Rajan Saxena, 4/e, Cenage Learning.

2. Marketing- Lamb, Hair, Sharma Mc Dannel, 1/e, Cengage Learning 2012.
3. Marketing: Marketing in the 21st Century - Evans & Berman, 2/e, Cengage Learning, 2005.
4. Marketing : Planning, Implementation, and Control - William M. Pride, Ferrell O. C , Cengage Learning, 2010.
5. Applied Case Studies in Marketing – Shajahan S, Primus Books, 2011.
6. Marketing In India: Text and Cases- Neelamegham S, 4/e, Vikas.

Website:

<http://www.fundula.com/allcourses>

FINANCIAL MANAGEMENT

Sub Code: 12MBA25	IA Marks : 50
No. of Lecture Hrs /week : 04	Exam Hrs. : 03
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(5 Hours)

Financial management – Introduction to financial management, objectives of financial management – profit maximization and wealth maximization. Changing role of finance managers. Interface of Financial Management with other functional areas. **Indian financial system** – Primary market, Secondary market – stocks & commodities market, Money market, Forex markets. (Theory Only)

Module II

(5 Hours)

Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture capital investing, Warrants. Angel investing Private equity, Warrants and convertibles (Theory Only)

Module III

(10 Hours)

Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization.

Module IV**(8 Hours)**

Cost of Capital Cost of capital – basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model). Cost of retained earnings. Determination of Weighted average cost of capital (WACC) and Marginal cost of capital.

Module V**(10 Hours)**

Investment decisions – Investment evaluation techniques – Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, Discounted pay back period , Accounting rate of return. Estimation of cash flow for new project, replacement projects.

Module VI**(6 Hours)**

Working capital management – factors influencing working capital requirements. Current asset policy and current asset finance policy. Determination of operating cycle and cash cycle. Estimation of working capital requirements of a firm.(Does not include Cash, Inventory & Receivables Management)

Module VII**(8 Hours)**

Capital structure and dividend decisions – Planning the capital structure. (No capital structure theories to be covered) Leverages – Determination of operating leverage, financial leverage and total leverage. Dividend policy – Factors affecting the dividend policy - dividend policies- stable dividend, stable payout. (No dividend theories to be covered).

Module VIII**(4 Hours)**

Emerging Issues in Financial management: Derivatives, Mergers and Acquisitions, Behavioral Finance, Financial Modelling, Financial engineering, risk management. (Theory Only).

Practical Components:

- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.

- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Students can choose the companies that have gone for stock split and Bonus issue in the last few years and study the impact of the same on the stock price.

RECOMMENDED BOOKS:

1. Financial Management - Khan M. Y.& Jain P. K, 6/e, TMH, 2011.
2. Financial Management - Pandey I. M, 10/e, Vikas.
3. Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
4. Financial Management, Kapil, Pearson Education, 2011.
5. Financial Management, Srivastav, Oxford University press, 2011.

REFERENCE BOOKS:

1. Fundamentals of Financial Management - Brigham & Houston, 10/e, Cengage Learning.
2. Fundamentals of Financial Management – Vanhorns & Bhandari, Pearson Education.
3. Contemporary Financial Management – Kothari & Dutta, Macmillan India Ltd.
4. Fundamentals of Corporate Finance - Stephen A. Ross, Wester Field, Jordan, 8/e, McGraw Hill, 2010.
5. Fundamentals of Financial Management –Vanhorne & Wachowicz, 13/e, PHI, 2011.
6. Corporate Finance – Damodaran, 2/e, Wiley India (P) Ltd., 2004
7. Financial Management –Shah, Wiley India (P) Ltd.
8. Principles of Managerial Finance - Gitman, 10/e, Pearson Education, 2004
9. Principles of Corporate Finance:Theory & Practice - Brealy and Myers, 10/e, TMH, 2012.
10. Financial Management & Policy- Vanhorne, James C., 12/e, Pearson, 2002
11. Fundamentals of Financial Management – Sharan, 2/e, Pearson, 2005.
12. Financial Management – Pares P. Shah, 2/e, Biztantra.
13. Financial Management: Comprehensive Text Book with case Studies – Ravi M. Kishore, 7/e, Taxmann.
14. Financial Management – Sudarshan Reddy, H P H

Website: <http://www.fundula.com/allcourses>

HUMAN RESOURCE MANAGEMENT

Sub Code: 12MBA26	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I **(6 Hours)**

Introduction, meaning and significance of HRM. Historical evolution of HRM. Major functions of HRM. Line functions and staff functions. Principles of HRM. HR Competencies. Institutions of repute which impart HRM education in India. Professional Associations in HRM. Career opportunities in HRM.

Module II **(6 Hours)**

Pre-recruitment functions of HRM- Organizational structure, Job analysis, HR Planning and budget approval. Strategic decision to outsource, engage contract workers or to recruit people on company role.

Module III **(8 Hours)**

Recruitment, selection and appointment: Meaning and significance of recruitment, process of recruitment, sources of recruitment, cost-benefit analysis of recruitment. Meaning and significance of selection, process of selection, selection techniques- tests, interviews and salary negotiation. Meaning and significance of appointment, process of appointment, legal aspects of employment contract, joining formalities and induction.

Module IV **(8 Hours)**

Training and development: Meaning and significance of training and development, Process of training development, needs analysis, training design, training implementation and training evaluation. Methods of training- on the job methods and off the job methods.

Module V**(6 Hours)**

Compensation and benefits: Meaning and significance of compensation and benefits. Basic salary, allowances, incentives, perks, and benefits. Structured pay scales of the government sector and cost to company approach of the private consultant. Statutory aspects of compensation and benefits.

Module VI**(8 Hours)**

Performance management: Meaning and significance of performance management. Process of performance management. Types of performance appraisal system. Performance goal setting, performance coaching and monitoring, performance evaluation and performance feedback. Aligning performance outcome to career and succession planning.

Module VII**(8 Hours)**

Employee Relations: Meaning and significance of employee relations. Employee relation in unionized and non-unionized organizations. Handling employee grievances. Employee discipline and domestic enquiry. Legal aspects of employee relations with reference to trade union Act, industrial employment standing orders Act and Industrial Disputes Act. Statutory aspects of health, welfare and safety of employees.

Module VIII**(6 Hours)**

Career and succession planning: Meaning, significance and process of career planning. Career stages, responsibility for career planning and career anchors. Meaning, significance and process of succession planning. Continuity of leadership and its impact on business.

Practical Component:

- Expose students to simulated recruitment exercises- Job profile, personal profile, advertisements etc.
- Expose students to standard selection tests followed in various sectors.
- Exploring performance appraisal practices in various sectors.
- Exploring training and development practices.
- Exploring employee separation practices.

- Give a job analysis case and ask the students to prepare job description and job specification.
- Conduct a debate on company employees versus contract employees.
- Give a case and ask the students to prepare the recruitment advertisement for a news paper.
- Ask the students to prepare an appointment letter for the post of office manager of a company known to you.
- Give a performance goal setting case and ask the students to perform dyadic role playing.

RECOMMENDED BOOKS:

1. Essentials of Human Resource Management and Industrial Relations – P Subba Rao, HPH.
2. Human Resource Management - Seema Sanghi, Macmillan, 2011.
3. Human Resource Management - Cynthia D. Fisher, 1/e, Cengage Learning..
4. Human Resource Management - Biswajeet Pattanayak, 3/e, PHI.
5. Human Resources Management: A South Asian Perspective, Snell, Bohlander, & Vohra, Cengage Learning, 16th Rep., 2012.
6. Human Resource Management - Lawrence S. Kleeman, Biztantra , 2012.
7. A Text Book of Human Resource Management – Dwivedi R. S, Vikas Publishing House.
8. Human Resource Management – Rao V. S. P, Excel Books, 2010.

REFERENCE BOOKS:

1. Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.
2. Human Resource Management in practice - Srinivas R. Kandula, PHI, 2009
3. Managing Human Resources - Luis R Gomez-Mejia, David B. Balkin, Robert L. Cardy, 6/e, PHI, 2010.
4. Human Resource Management - David A. Decenzo, Stephen P. Robbins, 10/e, Wiley India Pvt. Ltd., 2011.
5. Personnel Management – Memoria, HPH.

Website:

<http://www.fundula.com/allcourses>

SEMESTER III

STRATEGIC MANAGEMENT

Sub Code: 12MBA31	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (7 Hours)

Meaning and Nature of Strategic Management, its importance and relevance. Characteristics of Strategic Management. The Strategic Management Process. Relationship between a Company's Strategy and its Business Model.

Module II (7 Hours)

Strategy Formulation – Developing Strategic Vision and Mission for a Company – Setting Objectives – Strategic Objectives and Financial Objectives – Balanced Scorecard. Company Goals and Company Philosophy. The hierarchy of Strategic Intent – Merging the Strategic Vision, Objectives and Strategy into a Strategic Plan.

Module III (7 Hours)

Analyzing a Company's External Environment – The Strategically relevant components of a Company's External Environment – Industry Analysis – Industry Analysis – Porter's dominant economic features – Competitive Environment Analysis – Porter's Five Forces model – Industry driving forces – Key Success Factors – concept and implementation.

Module IV (6 Hours)

Analyzing a company's resources and competitive position – Analysis of a Company's present strategies – SWOT analysis – Value Chain Analysis – Benchmarking

Module V (7 Hours)

Generic Competitive Strategies – Low cost provider Strategy – Differentiation Strategy – Best cost provider Strategy – Focused Strategy – Strategic Alliances and Collaborative Partnerships – Mergers and Acquisition Strategies – Outsourcing Strategies – International Business level Strategies.

Module VI**(7 Hours)**

Business Planning in different environments – Entrepreneurial Level Business planning – Multi stage wealth creation model for entrepreneurs– Planning for large and diversified companies – brief overview of Innovation, integration, Diversification, Turnaround Strategies - GE nine cell planning grid and BCG matrix.

Module VII**(7 Hours)**

Strategy Implementation – Operationalizing strategy, Annual Objectives, Developing Functional Strategies, Developing and communicating concise policies. Institutionalizing the strategy. Strategy, Leadership and Culture. Ethical Process and Corporate Social Responsibility.

Module VIII**(8 Hours)**

Strategic Control, guiding and evaluating strategies. Establishing Strategic Controls. Operational Control Systems. Monitoring performance and evaluating deviations, challenges of Strategy Implementation. Role of Corporate Governance

Practical Components:

- Business Plan: Students should be asked to prepare a Business Plan and present it at the end of the semester. This should include the following:
 - Executive Summary
 - Overview of Business and industry analysis
 - Description of recommended strategy and justification
 - Broad functional objectives and Key Result Areas.
 - Spreadsheet with 5-year P&L, Balance Sheet, Cash Flow projections, with detailed worksheets for the revenue and expenses forecasts.
- Analysing Mission and Vision statements of a few companies and comparing them
- Applying Michael Porter's model to an industry (Retail, Telecom, Infrastructure, FMCG, Insurance, Banking etc)

- Pick a successful growing company. Do a web-search of all news related to that company over a one-year period. Analyse the news items to understand and write down the company's strategy and execution efficiency.
- Pick a company that has performed very badly compared to its competitors. Collect information on why the company failed. What were the issues in strategy and execution that were responsible for the company's failure in the market. Analyse the internal and external factors
- Map out GE 9-cell matrix and BCG matrix for some companies and compare them
- Conduct SWOT analysis of your institution and validate it by discussing with faculty
- Conduct SWOT analysis of companies around your campus by talking to them

RECOMMENDED BOOKS:

1. Crafting and Executing Strategy - Arthur A. Thompson Jr., AJ Strickland III, John E Gamble, 18/e, Tata McGraw Hill, 2012.
2. Strategic Management: Analysis, Implementation, Control – Nag A, 1/e, Vikas, 2011.
3. Strategic Management : An Integrated Approach - Charles W. L. Hill, Gareth R. Jones, Cengage Learning.
4. Business Policy and Strategic Management – Subba Rao P, HPH.
5. Strategic Management - Kachru U, Excel Books, 2009.

REFERENCE BOOKS:

1. Strategic Management: Concepts and Cases - David R ,13/e, PHI.
2. Strategic Management: Building and Sustaining Competitive Advantage- Robert A. Pitts & David Lei, 4/e, Cengage Learning.
3. Competitive Advantage - Michael E Porter, Free Press NY
4. Essentials of Strategic Management - Hunger, J. David, 5/e, Pearson.
5. Strategic Management – Saroj Datta, jaico Publishing House, 2011.
6. Business Environment for Strategic Management – Ashwathappa, HPH.
7. Contemporary Strategic Management-, Grant, 6/e, 2012, Wiley India.

OPERATIONS MANAGEMENT

Sub Code: 12MBA32	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: Introduction to Operations Management (6 Hours)

What is operations management? Production system concept, Transformation process, difference between products and services, OM in the organizational chart, operations as service, Historical development of OM, Current issues in operations management, Operations strategy, competitive dimensions, operations strategy in manufacturing, developing manufacturing strategy, operations strategy in services

Module II: Introduction and Break even analysis (6 Hours)

Break even analysis - Break even analysis in terms of physical units, sales value, and percentage of full capacity. Break even for Multi Product situations, Capacity expansion decisions, Make or Buy decisions, Equipment Selection decisions, Production process selection decisions, Managerial uses of break even analysis, Limitations of Breakeven analysis.

Module III: Forecasting (7 Hours)

Forecasting as a planning tool, forecasting time horizon, short and long range forecasting, sources of data, types of forecasting, qualitative forecasting techniques, quantitative forecasting models - Linear regression, Moving average, Weighted moving average, Exponential smoothing, Exponential smoothing with trends, Measurement of errors, Monitoring and Controlling forecasting models.

Module IV: Facility Planning (7 Hours)

Facilities location decisions, factors affecting facility location decisions and their relative importance for different types of facilities, Facility location models.

Facility layout planning. Layout and its objectives for manufacturing operations, warehouse operations, service operations, and office operations., principles, types of plant layouts – product layout, process layout, fixed position layout, cellular manufacturing layouts, hybrid layouts, Factors influencing layout changes.

Module V: Employee Productivity (6 Hours)

Productivity and work study

Productivity and the standard of living, Productivity and the organization, productivity, variables affecting labour productivity, work content and time, Work Study and related working conditions and human factors.

Method Study

Introduction to Method Study, Data collection, recording, examining, and improving work, Material flow and material handling study, Worker flow study, Worker area study,

Work Measurement

Introduction to Work Measurement, Work sampling study, Time study and setting standards

Module VI: Capacity Planning (6 Hours)

Introduction to capacity planning – CRP, MRP, MRP 2. MPS. Managerial importance of aggregate plans, alternatives for managing demand and supply, capacity augmentation strategies. Matching demand and capacity, demand chase aggregate planning, level production aggregate planning.

Module VII: Materials Management (10 Hours)

Role of Materials Management- materials and profitability, Purchase functions, Procurement procedures including bid systems, Vendor selection and development, Vendor rating, ethics in purchasing. Roles and responsibilities of purchase professionals. Concepts of lead time, purchase requisition, purchase order, amendments, forms used and records maintained.

Inventory Management: Concepts of inventory, types, Classification, selective inventory management, ABC VED, and FSN analysis. Inventory costs, Inventory models – EOQ, safety stocks, Re order point, Quantity discounts.

Stores- types, functions, roles responsibilities, Inventory records,

Module VIII: Designing Service Delivery systems (8Hours)

Introduction, distinctive characteristics of service operations, Service/product mix, intangible nature of services, simultaneous provision and consumption of services, time dependent capacity, customer management, multi site management, factors involved in delivering services, categories of services,

service delivery systems, design, IT based and other service delivery systems design, Issues to considered in delivery system design service profiling management

The course will cover both theory and numerical problems (theory and numerical in the ratio of 40 : 60 ratio)

Practical Component

- Students have to study plant layouts used for various types of organizations like manufacturing firms, retail outlets, hospitals, hotels, etc and prepare a report.
- Students have to identify different types of services and study how their delivery systems are designed
- Students have to prepare formats of different documents used in stores, purchase and inventory management like bin card, ledger, tender, quotation, indent etc

RECOMMENDED BOOKS:

1. Production and Operations Management – Ashwathappa K, & Sridhar Bhat K,Himalaya Publications.
2. Operations Management - Norman Gaither, Greg Frazier, 9/e, Cengage learning,2011.
3. Operations Management - Richard B. Chase, 11/e, TMH.
4. Operations Management-Terry Hill, Second edition, Palgrave Macmilan
5. Operations Management: Along the supply chain - Russel and Taylor, 6/e, Wiley India,2009.
6. Introduction to Operations and Supply Chain Management - Cecil Bozarth, Pearson,2011.
7. Production and Operations Management - Everette E. Adam, Jr, and Ronald J. Ebert,5/e, PHI, 2010.
8. Operations Management, Mahadevan, 2/e Pearson

REFERENCE BOOKS:

1. Production and Operations Management: Text and cases - Upendra kachru, 1/e, Excel Books.
2. Operations Now - Byron J. Finch, 3/e, Tata Mc-GrawHill, 2008.

3. Production and Operations management - Ajay K. Garg, Tata McGraw Hill, 2012.
4. Production and Operations Management – Chunawalla, Himalaya Publications.
5. Operations Management - William J. Stevenson, 9/e, The McGraw Hill, 2011.

Website:

<http://www.fundula.com/allcourses>

SEMESTER III: MARKETING AREA

BUSINESS MARKETING

Sub Code: 12MBAMM311	IA Marks : 50
No. of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(6 Hours)

Dimensions of Industrial Marketing: Nature of Industrial Marketing, Industrial Marketing vs. Consumer Marketing, Economics of Industrial demand – The Resellers Market – The Industrial Marketing Concept, Understanding Industrial Markets, Types of Industrial Markets, Classifying Industrial Products, Organizational Procurement Characteristics – The Industrial Marketing Environment, Environmental effect on Industrial Market with special reference to Government rule.

Module II

(7 Hours)

Nature of Industrial buying: Organisational buying Activity, Buying models and buying centre concept, Inter Personal Dynamics of Industrial Buying Behavior, Roles of Buying centre, Conflict Resolution in Decision Making Ethics in Purchasing

Module III**(8 Hours)**

Market Segmentation: Choosing Target Segments, Positioning, Differentiated and Un-Differentiated Markets, Concentrated and Niche Markets, Positioning Strategies, Difference between Industrial Market Research and Consumer Market Research

Module IV**(7 Hours)**

Formulating Product Planning: Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products

Business Service Marketing: Special Challenges

Module V**(6 Hours)**

Formulating Channel Strategy: Industrial Distributor, Definition, Geographical Distribution, Size Characteristics, operating characteristics, Role of Sales Agent and their drawbacks, choice of the right Distributors, Participation of other Channel Members in Industrial Distribution- Channel Logistics- Relationship of Logistics & Physical Distribution, Total Cost approach customer service, assessing the customer service, Identifying the cost centers.

Module VI**(6 Hours)**

Pricing Strategies: Price Determinants, Factors that Influence the Pricing Strategies, concept of learning curves, Pricing Strategies, Competitive Bidding, Leasing

Module VII**(6 Hours)**

The Promotional Strategies: Advertising in Industrial Markets, uses, Message Formulation, policies, media ,budgetary support, evaluation of advertising- sales Promotion- Use of Sales Promotion in Industrial Markets, trade shows and exhibitions B 2 B Forms of E-Commerce

Module VIII**(6 Hours)**

Management of Sales Force: Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for the sales force Deployment. **Personal Selling:** Selecting and Recruitment of Industrial sales person, sales training, Directing, Motivating, Task Assignment, Compensation, Measuring the Effectiveness of Sales Force.

Relationship Sales and Marketing, Four forms of Seller Roles

Case studies in Indian context only**(4 Hours)****Practical Components:**

- Go to a Government unit as well as a private manufacturing company: what are the differences in their purchasing procedures, pricing, payment terms etc? Study the tender method and its advantages/drawbacks?
- Attend a trade show of Industrial Products organized in your area and study the differences in the brochures, advertising, and the other marketing inputs.
- Imagine you are marketing a product like tyres which can be sold to the large buyers (Business Marketing) like KSRTC as well as in the retail market. Write down your assumptions as to what the 4 P's are likely to be and then compare it what it actually is?
- Visit an industrial unit and identify products where the seller sells directly as against using an intermediary or distributor. Why does this happen? What are the advantages and drawbacks of using a distributor?
- Conduct one week of Industry survey in the context of B to B marketing by visiting the companies or shops near the institutes. The data collected can be analyzed using appropriate statistical software and submit the report

RECOMMENDED BOOKS:

1. Industrial Marketing - Robert R. Reeder & Reeder, PHI
2. Business Marketing Management - Michael D. Hutt, Thomas W. Speh, 10/e, Cengage Learning, 2012.
3. Industrial Marketing - Krishna Havaladar, 3/e, TMH, 2011.
4. Business to Business Marketing - Vitale & Giglierano, 1/e, Cengage Learning.

5. Business Marketing: Connecting Strategy, Relationships and Learning - Robert Dwyer, John F. Tanner Jr., 4/e, TMH, 2006.

REFERENCE BOOKS:

1. Business Marketing - Frank G. Bingham Jr., and Others, 3/e, TMH, 2005.
2. Industrial Marketing - P. K. Ghosh, Oxford University Press.
3. Industrial Marketing – Mukherjee H. S, Excel Books.

SALES AND RETAIL MANAGEMENT

Sub Code: 12MBAMM312	IA Marks : 50
No. of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

PART – A

SALES MANAGEMENT

Module I

(8 Hours)

Introduction to sales management: Meaning, Personal Selling, the sales management process Emerging Trends in Sales Management, Qualities and Responsibilities of a sales manager. **Selling skills & selling strategies:** selling and buying styles, selling situations, selling skills, selling process

Module II

(6Hours)

Sales organization: Meaning, Factors influencing structure, organisational principle and design key account sales, sales process automation, emerging organisational designs **Management of Sales Territory & Sales Quota:** Sales territory, meaning, size, designing, sales quota, procedure for setting sales quota, Types of sales quota, Methods of setting sales Quota.

Module III

(6 Hours)

Recruitment and selection of sales force: Hiring process, sources, selection process. **Training:** - process, types of training and training methods, designing a sales training programme,

Module IV**(6 Hours)**

Sales force motivation: Nature of motivation, Importance, Process and factors in the motivation, **Compensation:** - Meaning, Types compensation plans and **evaluation:** - of sales force by performance and appraisal process.

Case Studies on Sales Management**(2 Hours)****PART – B****RETAIL MANAGEMENT****Module V****(7 Hours)**

Retailing: - Meaning, Nature, Classification, Growing Importance of Retailing, Factors Influencing Retailing, Functions of Retailing, and Retail as a career. Developing and applying Retail Strategy, Strategic Retail Planning Process, Retail Organization, The changing Structure of retailing, Classification of Retail Units, Types of Retail Formats

Module VI**(7 Hours)**

Setting up Retail organization: Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design.

Store Layout and Space planning: Types of Layouts, role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors.

Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centers, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of modern retails stores.

Module VII**(6 Hours)**

Emergence of Organized Retailing: Traditional Retailing, Organized Retailing in India, Retailing in rural India, Retail Environment in India, FDI in retailing, Role of IT in retailing, Emerging trends in organized retailing

Module VIII**(6 Hours)**

Retail Pricing: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies

Relationship Marketing in Retailing: Management & Evaluation of Relationships in Retailing, Retail **Research in Retailing:** Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing

Case Studies**(2Hours)****Practical Components:**

- Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why they chose a sales career, and what does it take to succeed in this profession.
- Go to a kirana store and a supermarket and compare the following: a) store arrangement b) No of brands carried c) pricing policies – are discounts given? d) service – personal or impersonal? Etc etc.
- Go to around three kirana stores in your neighbourhood (around 2 kms) and discuss with them the importance of location, pricing, credit policy, etc . What percentages of goods is sold ‘loose’ in each locality and compare this with the approximate income range of the customers? What are the retailers losses when a customer defaults in payment? Does he make up for it by increasing his prices to other customers?
- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. Does this buying behavior also depend on the personality of the individual doing the buying? Or the one doing the selling?
- Student can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.

RECOMMENDED BOOKS:

1. Sales & Distribution Management - Tapan K. Panda & Sunil Sahadev, 6/e, Oxford University Press.
2. Managing of Sales Force - Spiro Stanton Rich, 11/e, TMH, 2003.
3. Sales Management: Text and Cases – Ghosh P. K, HPH.
4. Integrated Retail Management - James R. Ogden & Denise T. Ogden, Biztantra, 2003.
5. Retail Management - Levy & Weitz, 8/e, TMH, 2012.
6. Retailing Management - Swapana Pradhan, 4/e, TMH, 2012.
7. Retail Marketing Management - Dravid Gilbert, 2/e, Pearson Education.
8. The Art of Retailing - A. J. Lamba, McGraw Hill.
9. Retail Management: A Strategic Approach - Barry Berman, Joel R. Evans, Pearson.

REFERENCE BOOKS:

1. Sales & Retail Management : An Indian Perspective - S.L. Gupta, 1/e, 2007, Excell books.
2. Salesmanship and Sales Management - Sahu P. K & Raut K. C, 3/e, Vikas Publishing House.
3. Sales Management - Douglas J. Dalrymple, William L Crowe, John Wiley & Co.
4. Sales & Distribution Management: An Indian Perspective – Gupta S. L, Excel Books, 2010.
5. Principles of Retail Management - Rosemary Varley, Mohammed Rafiq, Palgrave Macmillan, 2009..
6. Retail Management -Chetan Bajaj, Oxford University press.
7. Managing Retailing -Sinha, Piyush Kumar & Uniyal & Oxford University Press, 2010.
8. Retail Management – Arif Sheikh, HPH.

Website:

<http://www.fundula.com/allcourses>

CONSUMER BEHAVIOUR

Sub Code: 12MBAMM313	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I: Introduction to the study of Consumer Behaviour (4 Hours)

Meaning & Definition of CB, Difference between consumer & Customer, Nature & Characteristics of Indian Consumers, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.

Module II: Role of Research in understanding consumer behaviour (6 Hours)

Consumer Research: Consumer Research Paradigms (Qualitative & Quantitative Research Methods) Developing research objectives, collecting secondary data, designing primary research, data analysis and reporting research findings.

Models of Consumer Behaviour: Input-Process-Output Model, *Nicosia Model*, *Howard Sheth Model*, *Engel-Kollat-Blackwell Models* of Consumer Behaviour, **Internal Influences:** Motivation, Personality, Perception, Learning, Attitude, Communications, **External Influences:** Social Class, Culture, Reference Groups, Family members.

Levels of Consumer Decision Making – Consumer Buying Decision Process, Complex Decision Making or Extensive Problem Solving Model, Low Involvement Decision Making or Limited Problem Solving Model, Routinised Response Behaviour, Four views of consumer decision making.

Situational Influences- Nature of Situational Influence (The communication Situation, The Purchase Situation, The usage situation, The disposition situation) Situational Characteristics and consumption behaviour (Physical features, Social

Surroundings, Temporal Perspectives, Task Definition, Antecedent States.)

Module III: Individual Influences on Consumer Behaviour: (Part I)
(7 Hours)

A) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals.

Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives (Cognitive Preservation Motives, Cognitive Growth Motives, Affective Preservation Motives, Affective Growth Motives).

B) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity (Consumer Innovativeness and related personality traits, Cognitive personality factors, Consumer Materialism, Consumer Ethnocentrism), Brand Personality (Brand Personification, Gender, Geography, Colour), Self and Self-Image (One or Multiple selves, The extended self, Altering the self).

C) Perception: Basics of Perception & Marketing implications, Elements of Perception (Sensation, Absolute Threshold, Differential Threshold, Subliminal Perception), Dynamics of Perception (Perceptual Selection, Perceptual Interpretation, Perceptual Organization, perceived price, perceived quality, price/quality relationship, Perceived Risk, Types of risk, How consumers' handle risk).

Module IV: Individual Influences on Consumer Behaviour: (Part II)
(07 Hours)

A) Learning: Elements of Consumer Learning, Motivation, Cues, Response, Reinforcement, Marketing Applications of Behavioural Learning Theories, Classical Conditioning (Pavlovian Model, Neo-Pavlovian Model), Instrumental Conditioning, Elaboration Likelihood Model.

B) Attitude: Basics of attitude, The nature of attitude, Models of attitude and Marketing Implication,(Tri-component Model of attitude, Multiattribute attitude models.

C) Persuasive Communication : Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation.

Module V: External Influences on Consumer Behaviour: (Part I)

(7 Hours)

A) Social Class: Social Class Basics, What is Social Class?(Social class & Social status, The dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India

B) Culture and Subculture - Major Focus on Indian Perspective

Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour.

Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures (Nationality subcultures, Religious subcultures, geographic and regional subcultures, racial subcultures, age subcultures, sex as a subculture)

Cross-cultural consumer analysis: Similarities and differences among people, the growing global middle class; Acculturation is a needed marketing viewpoint, applying research techniques

Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems

Module VI: External Influences on Consumer Behaviour: (Part II)

(08 Hours)

Groups: Meaning and Nature of Groups, Types

Family: The changing structure of family, Family decision making and consumption related roles, Key family consumption roles, Dynamics of husband-wife decision making, The expanding role of children in family

decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications,

Reference Groups: Understanding the power & benefits of reference groups, A broadened perspective on reference groups, Factors that affect reference group influence, Types of reference groups, Friendship groups, Shopping groups, Work groups, Virtual groups, Consumer-action groups, Reference group appeals, Celebrities.

Module VII: Consumer Influence and Diffusion of Innovations:
(08 Hours)

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders

Diffusion of Innovations: Diffusion Process (Innovation, Communication channels, Social System, Time)

Adoption Process: Stages, categories of adopters

Post Purchase Processes: Post Purchase Processes, Customer Satisfaction, and customer commitment: Post purchase dissonance, Product use and non use, Disposition, Product disposition.

Module VIII: CRM & Online Decision Making **(05 Hours)**

A) Customer Relationship Management

Meaning & Significance of CRM, Types of CRM (Operational, Collaborative, Analytical), Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM

B) On-line Decision Making: Meaning & Process/Stages

Case studies in Indian context only **(04 Hours)**

Practical Component:

- Students can go to malls and unorganized retail outlets and observe the behaviour of consumers of different demographic segments

while buying different category of goods. Come back to class and present the findings / observations followed with a group discussion.

- Students can prepare a questionnaire and do a survey on consumer buying behaviour and present the findings in the class.
- Find three advertisements that appeal to the need for power, affiliation and achievement and discuss their effectiveness. Rewrite these for persons in different levels of Maslow's Hierarchy?
- Meet your friends and conduct a survey to find what are the important factors in their purchase of mobiles, shoes, bags etc. There are now plenty of advertisements regarding most products – how do they deal with this information overload?

RECOMMENDED BOOKS:

1. Consumer Behaviour - Leon Schiffman, Lesslie Kanuk, 10/e, Pearson, 2010.
2. Consumer Behaviour: Building Marketing Strategy – Del I. Hawkins, & Others, 11/e TMH.
3. Consumer behaviour - Jay D. Lindquist, Joseph Sirgy, 1/e, Cengage Learning.
4. Consumer behavior – David L. Louden, Della Bitta, 4/e, McGraw Hill.
5. Consumer Behaviour – Raju M. S & Dominique Xardel, Vikas Publishing House.

REFERENCE BOOKS:

1. Consumer Behaviour - Henry Asseal, Cenage Learning.
2. Consumer Behaviour in Indian Perspective – Suja Nair, Himalaya Publisher.
3. Customer Behavior : A Managerial Perspective – Sheth, Mittal, Cengage Learning.
4. Consumer Behaviour- Satish K. Batra & S H H Kazmi, Excell Books.
5. CRM – Alok Kumar, Chhabi Sinha, 7/e, Biztantra.
6. Customer Relationship Management - Peeru Ahamed & Sagadevan, Vikas Publishing.
7. Consumer Behaviour – Kumar Rajeev, Himalaya Publisher.

Website:

<http://www.fundula.com/allcourses>

SERVICES MARKETING

Sub Code: 12MBAMM314	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(6 Hours)

Introduction to services: Concepts, Contribution & reasons for the growth of services sector, Difference in goods and service in marketing, Myths about services, Characteristics of Services, Concept of service marketing triangle, Service marketing mix, GAP models of service quality. Marketing challenges in service industry.

Module II

(7 Hours)

Consumer behaviour in services: Search, Experience and Credence property, Customer expectation of services, Two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services.

Customer perception of services- Factors that influence customer perception of service, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

Module III

(5 Hours)

Understanding customer expectation through market research: Key reasons for GAP 1, Using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies Relationship marketing, Evaluation of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services.

Module IV**(8 Hours)**

Customer defined service standards: “Hard” & “Soft” standards, Process for developing customer defined standards.

Leadership & Measurement system for market driven service performance- Key reasons for GAP 2- service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality in offensive and defensive marketing.

Service design and Positioning – Challenges of service design, New service development – types, stages. Service blue printing- Using & reading blue prints. Service positioning – positioning on the five dimensions of service quality, Service Recovery.

Module V**(6 Hours)**

Employee role in service designing: Importance of service employee, Boundary spanning roles, Emotional labour, Source of conflict, Quality – productivity trade off, Strategies for closing GAP 3.

Customer’s role in service delivery- Importance of customer & customers role in service delivery, Strategies for enhancing- Customer participation, Delivery through intermediaries- Key intermediaries for service delivery, Intermediary control strategies.

Module VI**(5 Hours)**

Managing demand and capacity – Lack of inventory capability, Understanding demand patterns, Strategies & Tools for matching capacity and demand, coping with fluctuating demand, Waiting line strategies.

Module VII**(8 Hours)**

Role of marketing communication – Key reasons for GAP 4 involving communication, Four categories of strategies to match service promises with delivery, Methodology to exceed customer expectation.

Pricing of services- Role of price and value in provider GAP 4, Role of non monetary cost, Price as an indicator of service quality Approaches to pricing services, pricing strategies.

Module VIII**(6 Hours)**

Physical evidence in services: Types of service scapes, Role of service scapes, Frame work for understand service scapes & its effect on behaviour, Guidance for physical evidence strategies.

Case studies in Indian context only**(5 Hours)****Practical Component:**

- Ask students to choose a service industry of their choice at the beginning of the semester. Ask them to do an in-depth study of the industry and give a presentation at the end of every module relating the concepts of that module to the industry.
- Students can prepare service blueprints for any service of their choice.
- Students can do a role play on service recovery.
- Identify any existing services. Locate loopholes in their design and suggest modifications.
- Students can design and carry out a servqual study.

RECOMMENDED BOOKS:

1. Services Marketing-Valarie A. Zeithmal & Mary Jo Bitner, 5/e,TMH, 2011.
2. Services Marketing- Christopher Lovelock, Pearson Education, 2004.
3. Services Marketing:Operation, Management,and Strategy-Kenneth E Clow & David L Kurtz, 2/e, Biztantra, 2007.
4. Services Marketing: The Indian Perspective- Ravi Shankar, Excel Books, 2006.

REFERENCE BOOKS:

1. Services Marketing - Rajendra Nargundkar, 3/e, TMH, 2010.
2. Services Marketing - Govind Apte, Oxford, 2007.
3. Services Marketing - Hoffman & Bateson, 4/e, Cenage Learning, 2007.
4. Services Marketing - Peter Mudie and Angela Pirrie, 3/e, Elsevier, 2006.
5. Service Marketing – Jha S. M, HPH.

SEMESTER III: FINANCE AREA

ADVANCED FINANCIAL MANAGEMENT

Sub Code: 12MBAFM321	IA Marks : 50
No. of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverages.

Module II (6 Hours)

Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-orr model,. Strategies for managing surplus fund.

Module III (6 Hours)

Receivables Management – Credit management through credit policy variables, marginal analysis, Credit evaluation : Numerical credit scoring and Discriminate analysis. Control of accounts receivables, Problems on credit granting decision.

Module IV (6 Hours)

Inventory Management: Determinations of inventory control levels : ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis.

Module V**(10 Hours)**

Capital structure decisions – capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, traditional approach. Arbitrage process in capital structure. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy .

Module VI**(6 Hours)**

Dividend policy – Theories of dividend policy : relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. Legal and procedural aspects of dividends Corporate Dividend Tax.

Module VII**(6 Hours)**

Mergers and Acquisitions- Meaning and definition, . types of merger – motives behind mergers – theories of mergers – operating, financial and managerial synergy of mergers – value creation in horizontal, vertical and conglomerate mergers – internal and external change forces contributing to M & A activities

Module VIII**(10 Hours)**

Corporate financial modeling – Agency problem and consideration. Effect of inflation on ; Asset value, firm value, returns, Financial planning – Basis of financial planning, sales forecast method, pro-forma P & L account method, pro-forma balance sheet method, determination of External Financing Requirement (EFR). **Financial Management of sick units:** Definition of sickness, causes, symptoms, predictions, revival strategies, institutions for revival of sick units. Economic Value Added (EVA) – concept, components of EVA. Market Value Added (MVA)

Practical Components:

- Study the working capital financing provided by a Bank and submit the report on the same

- Study the annual report of any two companies and prepare a cash budget for next year.
- Visit a bank/financial institution providing factoring service and submit a report.
- Study any sick unit which has been revived and identify the steps taken in its revival
- Study the mergers/acquisitions taken place in the country in the recent past and submit the report.

RECOMMENDED BOOKS:

1. Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
2. Financial Management - M.Y. Khan & P.K. Jain, 6/e, TMH, 2011.
3. Financial Management - I.M. Pandey, 10/e, Vikas, 2011.

REFERENCE BOOKS:

1. Financial Management: Theory & Practice - Brigham & Ehrhardt, 10/e, Cenage Learning, 2004.
2. Ross, Westerfield & Jaffe, Corporate Finance– TMH – 8/e, 2010
3. Advanced Financial Management – Sudhindra Bhat – Excel Books.
4. Financial Management & Policy - Vanhorne, 12/e, Pearson
5. Financial management :principles and applications- Keown, Martin, Petty. Scott, PHI.
6. Principle of Corporate Finance– Brearly and Myers, 10/e, TMH, 2012.
7. Corporate Finance:Theory & Practice – Ashwath Damodaran, 2/e, Wiley India Pvt. Ltd., 2009.
8. Cases in Financial Management - Pandey & Bhatt, 2/e, TMH, 2012.
9. Corporate Financial Strategy – Ruth Bendel , ElSevier India (P) Ltd.
10. Contemporary Financial Management - Kothari & Dutta, Macmillan
11. Financial Management : Comprehensive Text Book with Case Studies – Ravi M. Kishore, 7/e, Taxmann.
12. Financial Management – Srivastava R. M, HPH.

INVESTMENT MANAGEMENT

Sub Code: 12MBAFM322/ 12MBABI332	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I Theory (6 Hours)
Investment: Attributes, Economic vs. Financial Investment, Investment and speculation, Features of a good investment, Investment Process.
Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives.

Module II Theory (6 Hours)
Securities Market: Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, Issue Management-Pre and Post Issue Management. Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures, Leading Stock Exchanges in India.
Stock Market Indicators- Types of stock market Indices, Indices of Indian Stock Exchanges.
Mutual Funds: Functions of Investment companies, Classification of Investment companies, Mutual Fund types, Performance of Mutual Funds-NAV.

Module III Theory & Problems (8 Hours)
Risk and Return Concepts: Concept of Risk, Types of Risk- Systematic risk, Unsystematic risk, Calculation of Risk and returns.
Portfolio Risk and Return: Expected returns of a portfolio, Calculation of Portfolio Risk and Return, Portfolio with 2 assets, Portfolio with more than 2 assets.

Module IV Theory & Problems (8 Hours)
Valuation of securities: Bond- Bond features, Types of Bonds, Determinants of interest rates, Bond Management Strategies, Bond Valuation, Bond Duration.
Preference Shares- Concept, Features, Yields.
Equity shares- Concept, Valuation, Dividend Valuation models.

Module V (10 Hours)
Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Global Economy, Domestic Economy, Business Cycles, Industry Analysis.
Company Analysis- Financial Statement Analysis, Ratio Analysis.
Technical Analysis – Concept, Theories- Dow Theory, Eliot wave theory. Charts-Types, Trend and Trend Reversal Patterns. Mathematical Indicators – Moving averages, ROC, RSI, Market Indicators. (Problems in company analysis & Technical analysis)

Module VI Theory & Problems (8 Hours)

Modern Portfolio Theory: Markowitz Model -Portfolio Selection, Opportunity set, Efficient Frontier.

Capital Asset pricing model: Basic Assumptions, CAPM Equation, Security Market line, Extension of Capital Asset pricing Model - Capital market line, SML VS CML.

Arbitrage Pricing Theory: Arbitrage, Equation, Assumption, Equilibrium, APT and CAPM.

Module VII Theory (4 Hours).

Market Efficiency and Behavioral Finance: Random walk and Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency. Behavioral Finance – Interpretation, Biases and critiques.

Module VIII Theory & Problems (6 Hours)

Portfolio Management: Diversification- Investment objectives, Risk Assessment, Selection of asset mix, Risk, Return and benefits from diversification.

Portfolio Management Strategies: Active and Passive Portfolio Management strategy.

Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans.

Portfolio Evaluation: Holding periods returns, Measures of portfolio performance.

(QUESTION PAPER- 50% Problems, 50% Theory)

Practical Components:

- A Student is expected to trade in stocks. It involves an investment of a virtual amount of Rs.10 lakhs in a diversified portfolio and manage the portfolio. At the end of the Semester the Net worth is to be assessed and marks may be given (to beat an index).
- Student has to Understand the functioning of stock exchange.
- Students can Study of the current Bond Issues in the market and present the same in the class.
- Students can do 1.Macro Economic Analysis for the Indian economy. 2. Industry Analysis for Specific Sectors. 3. Company Analysis for select companies.4.Practice Technical Analysis
- Students can study the mutual funds schemes available in the market and do their Performance evaluation.

RECOMMENDED BOOKS:

1. Investment Analysis and Portfolio management – Prasanna Chandra, 3/e, TMH, 2010.
2. Security Analysis & Portfolio Management – Punithavathy Pandian, 2/e, Vikas, 2005.
3. Investments – ZviBodie, Kane, Marcus & Mohanty, 8/e, TMH, 2010.
4. Investment Management – Bhalla V. K, 17/e, S.Chand, 2011.
5. Security Analysis & Portfolio Management – Fisher and Jordan, 6/e, Pearson, 2011.
6. Investment Management – Preethi Singh, 17/e, Himalaya Publishing House, 2010.
7. Security Analysis & Portfolio Management- Kevin S, 10/e, PHI, 2011.
8. Security Analysis & Portfolio Management – Sudhindra Bhat, Excel Books.
9. Investment Analysis & Portfolio Management– Reilly, 8/e, Cengage Learning.
10. Investments: Principles and Concepts – Charles P. Jones, 11/e, Wiley, 2010.

REFERENCE BOOKS:

1. Fundamentals of Investment – Alexander, Sharpe, Bailey, 3/e, PHI, 2001.
2. Security Analysis & Portfolio Management – Nagarajan K & Jayabal G , 1/e, New Age international, 2011.
3. Investment – An A to Z Guide, Philip Ryland, 1/e, Viva Publishers, 2010.
4. Guide to Investment Strategy-Peter Stanyer, 2/e, Viva Publishers, 2010.
5. Security Analysis & Portfolio Management – Sayesh N. Bhat , 1/e, Biztantra, 2011.
6. Security Analysis & Portfolio Management– DhaneshKhatri , Macmillan , 1/e, 2010.
7. Security Analysis & Portfolio Management – Avadhani V. A, HPH.

BANKING & FINANCIAL SERVICES

Sub Code: 12MBAFM323/ 12MBABI333	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (8 Hours)

Banking: Meaning and Definition, Evolution of Indian Banks.

Types of banks -Public Sector, Regional Banks, Performance of Public Sector banks, Private Sector Banks.

Commercial banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio economic development, Services rendered. Credit creation and Deployment of Funds. Bank Clearing House: Clearing Procedure.

Hi-tech Banking: Modern technology in Banking, Core banking, E Banking, ATM, EFTS, RTGS, Internet Banking, Mobile Banking.

Module II (8 Hours)

Bank and Customer: Relationship between the Banker and the Customer. Types of accounts and Deposits, Forms of lending. Bank`s obligation to customers. Documents & Procedure for loan.

Asset Liability Management in banks: Components of Liabilities and Components of Asstes, Significance of Asset Liability management, Purpose and objectives. ALM as co ordinated Balance Sheet management.

Banking Instruments- Cheque, bank draft, e-cheque, Travellers cheque, credit card, cheque cards, Debit card.

Concepts of Universal Banking

Module III (6 Hours)

International Banking: Exchange rates and Forex Business, Correspondent banking and NRI Accounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers, Role of ECGC, RBI and EXIM Bank.

Module IV (6 Hours)

Merchant banking: Origin, Services rendered by Merchant bankers, Functions of Lead managers, SEBI Guidelines for Merchant bankers.

Non-Banking Finance Companies: Functions, RBI Guidelines, Prudential Norms.

Module V (8 Hours)

Money Market: Structure – Organised and Un organized Market, Call Money Market, Bills market, Market for Government Securities.

Money market Instruments: Treasury Bills, Repurchase Agreements / Reverse Repo, Commercial bills, Commercial papers, Certificate of deposit.

Module VI**(8 Hours)**

Housing Finance: Types, Institutions and banks offering Housing Finance, Procedure and Interest rates. Income Tax Implication.

Leasing: Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and disadvantages of Leasing, Contents of a Lease Agreement, Matters on Depreciation and Tax, Problems in leasing, Factors influencing Buy or Borrow or Lease Decision.

Hire Purchasing: Concepts and features, Hire Purchase Agreement, Comparison of Hire Purchase with Credit sale, Installment sale and Leasing. Banks and Hire Purchase. Reverse mortgage.

Problems related to outright purchase, Hire purchase and Leasing.

Module VII**(6 Hours)**

Credit rating: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of different companies. Securitization of debt: Meaning, Features, Special Purpose Vehicle, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.

Factoring: Meaning, Definition, Functions, Types, Cost of Factoring. Forfeiting.

Module VIII**(6 Hours)**

Venture Capital: Concept, features, Origin in India and the current Indian Scenario.

Depository System: Objectives, activities, interacting systems, role of depositories and their services, Advantages of depository system -NSDL and CDSL. The process of clearing and settlement through Depositories, Depository Participants.

(QUESTION PAPER: Full Theory Case study-Problem on leasing, hire purchase, outright purchase.)

Practical Components:

- Students can study the procedure for opening a Savings account and a Current Account.
- Students can understand the criteria to be noted to Identify a true currency note.
- How to write and present a cheque.
- Students can study the Procedure to open a Demat account and an Online Trading Account.
- Students can study the Calculation of EMI.
- Students can study functioning of net Banking

- Students can study the Credit card and debit card procedure and account statements.

RECOMMENDED BOOKS:

1. Banking and Finance: Theory and Practice —Clifford Gomez, 1/e, PHI, 2011.
2. Bank Financial Management-Indian Institute of Banking and Finance, 1/e, Macmillan, 2010.
3. Management of Banking and financial services – Padmalatha & Justin Paul, 2/e, Pearson, 2010.
4. Financial Markets and Services – Gordon & Natarajan, 7/e, Himalaya publishing, 2011.
5. Financial services- Khan M.Y, 6/e, McGraw Hill, 2011.
6. Banking Theory and Practice – Shekar & Shekar, Vikas, 20/e, 2011.
7. Merchant Banking & Financial services- Vij & Dhavan, 1/e, McGraw Hill, 2011.
8. Indian Financial System – Machiraju, 4/e, Vikas, 2010.
9. Financial Services, Shanmugam, Wiley India, 2011

REFERENCE BOOKS:

1. Indian Financial System – Pathak, Pearson Education, 3/e, 2011.
2. Merchant Banking:Principles and Practice - Machiraju H. R, New Age International.
3. Indian Financial System—Khan M. Y, 7/e, TMH, 2011.
4. Banking Theory, Law and Practice – Gordon & Natarajan, 22/e, Himalaya, 2011.
5. Banks and Institutional Management – Vasant Desai, HPH.
6. Dynamics of Financial Markets and Institutions in India – Srivastava R. M, Excel Books, 2010.

COST MANAGEMENT

Sub Code: 12MBAFM324	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	
Ratio of theory to problems= 40:60	

Module I

(5 Hours)

Introduction to Cost Management- Cost Accounting to Cost Management- Cost Management Tools- A Strategic View to Cost Management.

Module II (10 Hours)
Overheads, Classification and Collection, Difference between Cost Allocation and Cost Apportionment, (Full fledged Problems on Primary and secondary distribution, Simultaneous equations, Absorption of Overhead, Theory on Under and Over absorption of Overhead

Module III (10 Hours)

MARGINAL COSTING – Nature and Scope- Applications-Break even charts and Point, Decision Making (all types with full problems)Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing.

Module IV (8 Hours)

Budgetary Control :- Objectives of Budgetary control, Functional Budgets, Master Budgets, Key Factor Problems on Production Budgets and Flexible Budgets.

Standard Costing :- Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labour variances only .

Module V (8 Hours)

Demerits of Traditional Costing, Activity Based Costing, Cost Drivers, Cost Analysis Under ABC (Unit level, Batch Level and Product Sustaining Activities), Benefits and weaknesses of ABC, Simple Problems under ABC.

Module VI (5 Hours)

Cost Audit,-objectives,, Advantages, Areas and Scope of Cost Audit , Cost Audit in India --Practical—Read the contents of the report of Cost Audit and the annexure to the Cost Audit report.

Management Audit- Aims and the objectives, Scope of Management Audit.

Module VII (5 Hours)

Reporting to Management – Purpose of reporting-Requisites of a good report,, Classifications of Report, Segment reporting, Applicability of Accounting Standard 17, Objectives, Users of Segment reporting.

Module VIII**(5 Hours)**

Cost Reduction, and Cost Control, Target Costing – its Principles, Balanced Scorecard as a performance measure- Features- Purpose, Reasons for use of Balanced scorecard.

Proportion of problems to theory 50%

Practical components:

- Students can taken up a product and get details about the actual cost of raw material, wages and other cost and prepare a cost statement. Standard cost of each component has to be obtained and the variance can be calculated to find the efficiency of Purchase, Operations and Production in charge.

RECOMMENDED BOOKS:

1. Cost Accounting :Theory and Practice - Bhabatosh Banerjee, 12/e, PHI.
2. A Text book of Cost and Management Accounting – Arora M. N, 11/e, Vikas.
3. Financial Statement Analysis and Reporting - Mohana Rao P, PHI, 2011.
4. Cost Management :A strategic Approach - Vaidya S. C, Suveera Gill Macmillan 2010.
5. Cost Accounting- Jawaharlal, & Seema Srivastava, 4/e, TMH.
6. Accounting & Costing for Management – Sinha P. K, Excel Books, 2010.

REFERENCE BOOKS:

1. Cost Accounting – Khan M. Y and Jain P. K, TMH.
2. Principles and Practice of Cost Accounting - Bhattacharyya, 3/e, PHI.
3. Cost and Management Accounting- Arora M. N, 3rd enlarged and Rev. ed., HPH.
4. Managerial Accounting- James Jiambalvo, 2/e, Wiley India Pvt. Ltd.
5. Management Accounting - Khan M. Y and Jain P. K, 6/e, McGraw Hill, 2012.
6. Advanced Cost Accounting – Madegowda J, HPH.
7. Cost and Management Accounting – Arora M. N, 3/e, HPH.

SEMESTER III: BANKING AND INSURANCE AREA

PRINCIPLES AND PRACTICE OF BANKING AND INSURANCE

Sub Code: 12MBABI331	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)
Banking system and structure in India- Types of banks in operation – Role of Reserve Bank and GOI as regulator of banking system – Provisions of Banking Regulation Act & Reserve Bank of India Act

Module II (9 Hours)
The terms banker and customer – Types of relationship between banker and customer – Bankers obligations to customers – Right of lien, setoff, appropriation– Provisions of Negotiable Instrument Act, 1881 – Bankers legal duty of disclosure and related matters

Module III (4 Hours)
Customers` accounts with banks – Opening- operation – KYC norms and operation – Types of accounts and customers – Nomination – Settlement of death claims

Module IV (6 Hours)
Banking Technology- Home banking – ATMs- Internet banking – Mobile banking- Core banking solutions – Debit, Credit, and Smart cards – EFD – RTGS

Module V (4 Hours)
International banking – Exchange rates – Documentary letter of credit – financing exporters and importers – ECGC Policies and guarantees

Module VI (6 Hours)
Banker as lender – Types of loans – Overdraft facilities – Discounting of bills – Financing book dates and supply bills- Charging of Security bills-pledge – mortgage – assignment.

Module VII (9 Hours)

Introduction to Insurance – Insurable Interest- Human Life value Concept- Elements of Insurance Risk – Principles of indemnity – Principles of Utmost good faith- Principle of Subrogation- Insurable interest – Proximate Cause- Players in Life and Non-Life Insurance sector – Insurance documents – Procedure for issue – Alterations- Duplicate policy – Nomination- Assignment – Lapse and revivals- Assignment – Foreclosure

Module VIII (12 Hours)

Types of Insurance – Life Insurance and General Insurance Products including unit linked plans – Re-Insurance – Nature of Re-Insurance risk – Types of Re -Insurance – Reinsurance Agreements -Legal framework of life and general insurance – Underwriting (Process and Principles) – underwriting in Life insurance – Underwriting in Nonlife insurance

Bancassurance- concepts – critical issues – functional aspects – Indian Scenario – Future Prospects –Insurance Accounting – Financial Analysis and valuations- Solvency and performance measures.

Practical Components:

- Students can Understand Universal Banking & Cross Selling concepts adopted by banks
- Students can Understand Customer Profiling aspects adopted by banks
- Students can Understand Advertisement & Publicity efforts done by banks using ATMs (making a checklist of the publicity material found in an ATM – preferably in a private bank ATM)
- Study an issued insurance policy
- List out all the insurance companies operating in India in both PSU & Private space and submit the report on the same
- List out the names of banks that have tie-ups with various insurance companies (for example – Karnataka Bank tie-up with Met Life Insurance Co.) and submit the report on the same
- Write about Third Party Administrator (TPA) in a mediclaim policy

RECOMMENDED BOOKS:

1. Fundamentals of Insurance –Gupta P. K, Himalaya Publishing House, 2011
2. Principles and practices of Banking - IIBF, 2/e, Macmillan, New Delhi.

3. Elements of Banking & Insurance – Jyothsna Sethi & Nishwan Bhatia, PHI, 2009.
4. Bank Management - Koch W, Timothy, & S. Scott, Cengage Learning, New Delhi.
5. Banking and Insurance, Mohapatra and Acharya, Pearson, 2012.

REFERENCE BOOKS:

1. Insurance & Risk management - Gupta P. K, Himalaya Publishing House, 2011.
2. Managing Life Insurance – Shashidharan K Kutty- Prentice Hall of India.
3. Banking Theory, Law and practice - Sunderaram and Varshney, Sultan Chand & Sons, New Delhi.
4. Banking and Financial System - Prasad K, Nirmala, Chandradas J. Himalaya Publishing House, Mumbai.
5. Management of Banking and Insurance – Sondhi N. K, Vrinda Publications.
6. Banking and Insurance – Aggarwal O. P, HPH.

INVESTMENT MANAGEMENT

Sub Code: 12MBABI332/ 12MBAFM322	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I -Theory (6 Hours)

Investment: Attributes, Economic vs. Financial Investment, Investment and speculation, Features of a good investment, Investment Process.
 Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives.

Module II -Theory (6 Hours)

Securities Market: Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, Issue Management-Pre and Post Issue Management. Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures, Leading Stock Exchanges in India.

Stock Market Indicators- Types of stock market Indices, Indices of Indian Stock Exchanges.

Mutual Funds: Functions of Investment companies, Classification of Investment companies, Mutual Fund types, Performance of Mutual Funds-NAV.

Module III Theory & Problems (8 Hours)

Risk and Return Concepts: Concept of Risk, Types of Risk- Systematic risk, Unsystematic risk, Calculation of Risk and returns.

Portfolio Risk and Return: Expected returns of a portfolio, Calculation of Portfolio Risk and Return, Portfolio with 2 assets, Portfolio with more than 2 assets.

Module IV Theory & Problems (8 Hours)

Valuation of securities: Bond- Bond features, Types of Bonds, Determinants of interest rates, Bond Management Strategies, Bond Valuation, Bond Duration.

Preference Shares- Concept, Features, Yields.

Equity shares- Concept, Valuation, Dividend Valuation models.

Module V (10 Hours)

Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Global Economy, Domestic Economy, Business Cycles, Industry Analysis.

Company Analysis- Financial Statement Analysis, Ratio Analysis.

Technical Analysis – Concept, Theories- Dow Theory, Eliot wave theory. Charts-Types, Trend and Trend Reversal Patterns. Mathematical Indicators – Moving averages, ROC, RSI, Market Indicators. (Problems in company analysis & Technical analysis)

Module VI - Theory & Problems (8 Hours)

Modern Portfolio Theory: Markowitz Model -Portfolio Selection, Opportunity set, Efficient Frontier.

Capital Asset pricing model: Basic Assumptions, CAPM Equation, Security Market line, Extension of Capital Asset pricing Model - Capital market line, SML VS CML.

Arbitrage Pricing Theory: Arbitrage, Equation, Assumption, Equilibrium, APT and CAPM.

Module VII -Theory (4 Hours).

Market Efficiency and Behavioral Finance: Random walk and Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for

different forms of market efficiency. Behavioral Finance – Interpretation, Biases and critiques.

Module VIII Theory & Problems

(6 Hours)

Portfolio Management: Diversification- Investment objectives, Risk Assessment, Selection of asset mix, Risk, Return and benefits from diversification.

Portfolio Management Strategies: Active and Passive Portfolio Management strategy.

Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans.

Portfolio Evaluation: Holding periods returns, Measures of portfolio performance.

(QUESTION PAPER- 50% Problems, 50% Theory)

Practical Components:

- A Student is expected to trade in stocks. It involves an investment of a virtual amount of Rs.10 lakhs in a diversified portfolio and manage the portfolio. At the end of the Semester the Net worth is to be assessed and marks may be given (to beat an index).
- Student has to Understand the functioning of stock exchange.
- Students can Study of the current Bond Issues in the market and present the same in the class.
- Students can do 1.Macro Economic Analysis for the Indian economy. 2. Industry Analysis for Specific Sectors. 3. Company Analysis for select companies.4.Practice Technical Analysis
- Students can study the mutual funds schemes available in the market and do their Performance evaluation.

RECOMMENDED BOOKS:

1. Investment Analysis and Portfolio management – Prasanna Chandra, 3/e, TMH, 2010.
2. Investments – ZviBodie, Kane, Marcus & Mohanty, 8/e, TMH, 2010.
3. Investment Management – Bhalla V. K, 17/e, S.Chand, 2011.
4. Security Analysis & Portfolio Management – Fisher and Jordan, 6/e, Pearson, 2011.
5. Security Analysis & Portfolio Management – Punithavathy Pandian, 2/e, Vikas, 2005.
6. Investment Management – Preethi Singh, 17/e, Himalaya Publishing House, 2010.
7. Security Analysis & Portfolio Management- S.Kevin, 10/e, PHI, 2011.

8. Security Analysis & Portfolio Management – Sudhindra Bhat, Excel Books.
9. Investment Analysis & Portfolio Management– Reilly, 8/e, Cengage Learning.
10. Investments: Principles and Concepts – Charles P. Jones, 11/e, Wiley, 2010.

REFERENCE BOOKS:

1. Fundamentals of Investment – Alexander, Sharpe, Bailey, 3/e, PHI, 2001.
2. Security Analysis & Portfolio Management – K.Nagarajan &G. Jayabal , 1/e, New Age international, 2011.
3. Investment – An A to Z Guide, Philip Ryland, 1/e, Viva Publishers, 2010.
4. Guide to Investment Strategy-Peter Stanyer, 2/e, Viva Publishers, 2010.
5. Security Analysis & Portfolio Management – Sayesh N. Bhat , 1/e, Biztantra, 2011.
6. Security Analysis & Portfolio Management– DhaneshKhatri , Macmillan , 1/e, 2010.
7. Security Analysis & Portfolio Management – Avadhani V. A, HPH.

BANKING & FINANCIAL SERVICES

Sub Code: 12MBABI333/12MBAFM323	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(8 Hours)

Banking: Meaning and Definition, Evolution of Indian Banks.

Types of banks -Public Sector, Regional Banks, Performance of Public Sector banks, Private Sector Banks.

Commercial banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio economic development, Services rendered. Credit creation and Deployment of Funds. Bank Clearing House: Clearing Procedure.

Hi-tech Banking: Modern technology in Banking, Core banking, E Banking, ATM, EFTS, RTGS, Internet Banking, Mobile Banking.

Module II (8 Hours)
Bank and Customer: Relationship between the Banker and the Customer. Types of accounts and Deposits, Forms of lending. Bank`s obligation to customers. Documents & Procedure for loan.
Asset Liability Management in banks: Components of Liabilities and Components of Asstes, Significance of Asset Liability management, Purpose and objectives. ALM as co ordinated Balance Sheet management.
Banking Instruments- Cheque, bank draft, e-cheque, Travellers cheque, credit card, cheque cards, Debit card.
Concepts of Universal Banking

Module III (6 Hours)
International Banking: Exchange rates and Forex Business, Correspondent banking and NRI Accounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers, Role of ECGC, RBI and EXIM Bank.

Module IV (6 Hours)
Merchant banking: Origin, Services rendered by Merchant bankers, Functions of Lead managers, SEBI Guidelines for Merchant bankers.
Non-Banking Finance Companies: Functions, RBI Guidelines, Prudential Norms.

Module V (8 Hours)
Money Market: Structure – Organised and Un organized Market, Call Money Market, Bills market, Market for Government Securities.
Money market Instruments: Treasury Bills, Repurchase Agreements / Reverse Repo, Commercial bills, Commercial papers, Certificate of deposit.

Module VI (8 Hours)
Housing Finance: Types, Institutions and banks offering Housing Finance, Procedure and Interest rates. Income Tax Implication.
Leasing: Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and dis advantages of Leasing, Contents of a Lease Agreement, Matters on Depreciation and Tax, Problems in leasing, Factors influencing Buy or Borrow or Lease Decision.
Hire Purchasing: Concepts and features, Hire Purchase Agreement, Comparison of Hire Purchase with Credit sale, Installment sale and Leasing. Banks and Hire Purchase. Reverse mortgage.
Problems related to outright purchase, Hire purchase and Leasing.

Module VII (6 Hours)
Credit rating: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of

different companies. Securitization of debt: Meaning, Features, Special Purpose Vehicle, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.

Factoring: Meaning, Definition, Functions, Types, Cost of Factoring. Forfeiting.

Module VIII

(6 Hours)

Venture Capital: Concept, features, Origin in India and the current Indian Scenario.

Depository System: Objectives, activities, interacting systems, role of depositories and their services, Advantages of depository system -NSDL and CDSL. The process of clearing and settlement through Depositories, Depository Participants.

Practical Components:

- Students can study the procedure for opening a Savings account and a Current Account.
- Students can understand the criteria to be noted to Identify a true currency note.
- How to write and present a cheque.
- Students can study the Procedure to open a Demat account and an Online Trading Account.
- Students can study the Calculation of EMI.
- Students can study functioning of net Banking
- Students can study the Credit card and debit card procedure and account statements.

(QUESTION PAPER: Full theory. Case study-Problem on leasing, hire purchase, outright purchase.)

RECOMMENDED BOOKS:

1. Banking and Finance: Theory and Practice —Clifford Gomez, 1/e, PHI, 2011.
2. Bank Financial Management-Indian Institute of Banking and Finance, 1/e, Macmillan, 2010.
3. Management of Banking and financial services – Padmalatha & Justin Paul, 2/e, Pearson, 2010.
4. Financial Markets and Services – Gordon & Natarajan, 7/e, Himalaya publishing, 2011.
5. Financial services- Khan M.Y, 6/e, McGraw Hill, 2011.
6. Banking Theory and Practice – Shekar & Shekar, Vikas, 20/e, 2011.
7. Merchant Banking & Financial services- Vij & Dhavan, 1/e, McGraw Hill, 2011.

8. Indian Financial System – Machiraju, 4/e, Vikas, 2010.
9. Financial Services, Shanmugam, Wiley India, 2011

REFERENCE BOOKS:

1. Indian Financial System – Pathak, Pearson Education, 3/e, 2011.
2. Merchant Banking: Principles and Practice - Machiraju H. R, New Age International.
3. Indian Financial System—Khan M. Y, 7/e, TMH, 2011.
4. Banking Theory, Law and Practice – Gordon & Natarajan, 22/e, Himalaya, 2011.
5. Banks and Institutional Management – Vasant Desai, HPH.
6. Dynamics of Financial Markets and Institutions in India – Srivastava R. M, Excel Books, 2010.

Website: <http://www.fundula.com/allcourses>

BANKING AND INSURANCE PRODUCTS

Sub Code: 12MBABI334	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (5 Hours)
Deposit Products – Savings Bank – Current Account – Demand deposits – Term Deposits – Concepts of low cost deposits – Certificate of deposit – Bulk deposit.

Module II (7 Hours)
Remittance Products: Demand draft – Travelers’ Cheques – Gift Cheque – Mail Transfer – Telegraphic Transfer – Multicity cheques – EFD – RTGS

Module III (9 Hours)
IT Products: MICR Cheques – Channel Banking – Core Banking – Internet Banking Mobile Banking – ATMS – Debit card – Credit card – RTGS – EFD.

Module IV (9 Hours)
Loan Products: Short term loans- Long term loans – Consumer loans- Education loans – Housing loans – Business loans – Farm loans- Kisan Credit cards – Corporate loans – Syndication – Micro Finance.

Module V (10 Hours)
Life Insurance Products: Types of insurance policies -Features of term insurance – Features of Endowment Assurance – Role of Term and Endowment in product designing – Types of Life Insurance policies – Annuity & pension policies – Whole life policies – Money back policies – Market-Linked Insurance products, Riders, Pension Products, Marketing of Life Insurance

Module VI (4 Hours)
Health Insurance Products: Individual Medical expense Insurance – Long term care coverage – Disability Income Insurance – Mediclaim Policy – Group Mediclaim Policy – Personal Accident policy

Module VII (6 Hours)
Fire Insurance – Fundamental principles – Fire insurance Contracts - Proposals Fire insurance proposals – Special Coverages –Fire Insurance claims
Motor Vehicles Insurance: Need – Types – Factors to be considered for premium fixing –Motor Insurance claims

Module VIII (6 Hours)
Miscellaneous Products: Burglary – Jeweller’s Block Insurance – Baggage Insurance – Banker’s Indemnity Insurance – Aviation Insurance – Fidelity guarantee insurance – Public liability insurance.

Practical Components:

- Students can prepare a matrix on the risk cover required by an individual under Life Insurance product
- Students can prepare a matrix on the health cover (mediclaim) insurance required by a family under general insurance product
- Students can analyse and report “During a life time what all insurance products that an individual under life & non-life insurance would they avail”

RECOMMENDED BOOKS:

Banking

1. Principles and practices of Banking – IIBF, 2/e, Macmillan, 2011.
2. Elements of Banking & Insurance - Jyothsna Sethi & Nishwan Bhatia Prentice Hall of India, 2009.

Insurance

1. Fundamentals of Insurance - Gupta, P K, 2/e, Himalaya Publishing House, 2011.
2. Fundamentals of Insurance – Kaninika Mishra, Prentice Hall of India, 2010.
3. Insurance Management: Text & Cases - Sahoo, S C and Das S C – Himalaya Publishing House, 2011.
4. Principle and Practice of insurance - Periswamy - Himalaya publishing House, 2011.
5. Insurance: Theory & Practice - Nalini Tripathi & Prabir Pal, PHI, 2010.
6. Insurance Management - Ganguly, Anand, New Age International, New Delhi.

SEMESTER III: HUMAN RESOURCES AREA

RECRUITMENT AND SELECTION

Sub Code: 12MBAHR341	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I **(5 Hours)**

Job analysis: Meaning and significance, approaches in job analysis, methods of data collection and analysis. Job description and job specification. Contents of job description and job specification.

Module II **(5 Hours)**

Legal Aspects and Organization Policy: Nationality, gender, age, job reservation for weaker sections of the society, equal opportunity employment, employment of foreign workers and visa restrictions, agreement with employee unions, organizational policy on hiring.

Module III **(5 Hours)**

Human resource planning: Meaning and significance of human resource planning, data gathering, analysis, decision making and budget approval in HR planning.

Module IV **(5 Hours)**

Recruitment: Meaning and significance, principles of recruitment, strategic choices in recruitment- automating, out sourcing, contracting and recruiting. Targeting right source, internal recruitment- meaning and significance, advantages and disadvantages. External recruitment- meaning and significance, advantages and disadvantages.

Module V (6 Hours)

Medium of Recruitment: What is right medium and how to choose it- Reach and Economics? Medium of internal recruitment- Display banners at workplace, internal circulars, emails, display on the company website, scanning the database of HR department. Medium of external recruitment- Campus recruitments, display banner in front of workplace, display on the company website, social networking sites, display on the recruitment portals, accessing the data base of recruitment portals, news paper advertisement, job fairs, employment exchanges, recruitment consultants, labour contractors, employee referrals, display banners at public places, data base of professional associations, ex- servicemen rehabilitation centre, unsolicited applicants, blending internal and external recruitments, segregation of eligible and ineligible persons.

Module VI (16 Hours)

Assessing candidates for selection: Testing for aptitude and Skills: Meaning and significance of aptitude and skills, assessing approaches- application blanks, skill tests, aptitude tests etc, reliability and validity of tests, testing methods, testing conditions and procedure, evaluating test scores, short listing ratio, short listing criteria- benchmark approach and descending order approach.

Interviewing- Meaning and significance, methods, advantages and limitations. Interviewers and their preparedness. Interview content and process. Factors to be assessed in interviewing. Personality and physical features, emotional maturity, oral communication, job knowledge, person-job fitness, person-organization fitness, expectation-offer compatibility and salary negotiation.

Assessing physical fitness and health- Meaning and significance, methods, age, gender, sensory fitness, motor fitness, testing for physical endurance, acceptable standards of health.

Antecedent Verification- Meaning and significance, education, age, qualification, experience, good behavior at work, performance at work, verification for criminal antecedents.

Module VII (10 Hours)

Appointment and joining: Appointment - Meaning and significance, offer of appointment and acceptance, appointment order, contents of appointment order and its acceptance. Bond for minimum service, bond for good conduct, caution deposit against possible losses.

Joining- Fixing a joining date. Joining day formalities, verification and collection of certificate copies, collecting photos, PAN number and passport copy. Providing access to enter and exit. Providing place to work, providing furniture, stationary, equipment, entering name in the muster roll, opening the personal file etc.

Module VIII

(4 Hours)

Induction and deployment: Meaning, significance, methods, and contents introducing new employee to the existing employees in person or through communication. Showing all the departments and facilities to the new employee. Basic rules to be followed at work to deal with people issues, processes and task issues. Deployment of right person to right position.

Practical components:

- Students are expected to conduct a mock induction session for the selected batch of students and submit a report as part of the assignments.
- **Students can identify various sources of recruitment used by Indian organization for lower, middle level and top level management jobs.**
- Identify three to four jobs generally known to most of the students and ask them to collect the data and prepare job description and job specification for the said jobs.
- Obtain online access to the resume data base of Naukri.com or Monsterindia.com for a week and give at least four job descriptions and specification to each student, to search and download from the data base at least five resumes for each position
- Form groups of five to six students. Ask each group to identify and present the parameters/ standards for selecting a (a) police constable, (b) forest guard, (c) computer operator, (d) software programmer, (e) bank cashier and a (f) nurse.

RECOMMENDED BOOKS:

1. Human Resource Selection - Gatewood R. D, Field H. S, Barrick R. Cengage Learning, 2008.

2. Recruiting, Interviewing, Selecting, and Orienting New Employees - Arthur D, PHI, 2011.
3. Strategic Staffing - Phillips J. M and Gully S.M., Pearson Education, 2009.

REFERENCE BOOKS:

1. Employee Selection - Litty M. Berry, Wadsworth, Cengage Learning, 2003.
2. Staffing Organizations - Heneman H. G & Judge T. A., McGraw-Hill, 2009.
3. Managing Recruitment Functions – Sahu R. K, Excel Books, 2010.

COMPENSATION AND BENEFITS

Sub Code: 12MBAHR342	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (5 Hours)

Introduction to Compensation and Benefits: Meaning and Significance, purpose, components, types. Piece rated, time rated and skills based approaches. Daily, weekly and monthly payments. Characteristics of best compensation plans. Fixed pay and variable pay, Understanding the terminologies- compensation, benefit, salary, pay, basic pay, wage, allowance, incentive, commission, reward, recognition, perquisite, fringe benefit, , subsistence allowance, reimbursement, consolidated pay, stipend, service charges, pay scales, severance pay, terminal benefit, bonus, joining bonus, retention bonus, relocation pay, increment, and stagnation increment. Workers compensation, managerial compensation and executive compensation.

Module II (5 Hours)

Economic theories of wages: Importance of economic theories in the understanding of compensation and benefits, the evolution of just wage doctrine of Thomas Aquinas, subsistence wage theory of Adam Smith and David Ricardo, wage fund theory of John Stuart Mill and Nassau Senior, marginal productivity theory of Alfred Marshal and John Bates Clark, bargaining theory by Arthur Cecil Pigou, residual claimant theory by Francis A. Walker, surplus value theory by Carl Marx, and other theories.

Module III (6 Hours)
Principles of compensation determination: Meaning and Significance compensation principles. Equity (internal and external), bargaining ability of employee unions and individual employees, statutory requirements, ability to pay, worth of the job, demand-supply conditions in job market. Job evaluation and salary survey

Module IV (8 Hours)
Cost to Company (CTC) Method: Meaning and significance, advantages and limitations, CTC, Gross salary and Net salary. Components of CTC- Monthly, quarterly, annual and one time components. Advance components and deferred components. Attendance linked components, seniority linked components, and performance linked components. Paid leave and holidays, conveyance, leave travel concession, food coupons, housing, Benefits, perquisites and statutory components.

Module V (14 Hours)
Benefits and incentives: Meaning, significance and characteristics, basis for benefits payment, statutory benefits- employees state insurance, provident fund, gratuity, unemployment benefits, skills up gradation benefits, pension, employees compensation and Maternity benefit, non statutory benefits- insurance against injury, illness, disability, fatal accident and death. Meaning and significance of incentives, basis for incentives payment, purpose and types- regular, periodical and occasional incentives, cash incentives and incentives as fringe benefits. Stock options.

Module VI (6 Hours)
Executive compensation: Meaning and significance of executive compensation, unique features of executive compensation, fixed components and variable components, perquisites and benefits basis for determining executive compensation, statutory upper limit on executive compensation as per Companies Act 1956, stock options, joining bonus, retention bonus and severance pay.

Module VII (6 Hours)
Law Relating to compensation: Payment of wages Act 1936, Minimum wages Act 1948, Payment of Bonus Act 1965, and Equal Remuneration Act 1976.

Module VIII (6 Hours)
Taxation on salary and benefits: Meaning and significance of taxation on salary, Professional tax of state government on salaries people, income tax of

central government on salaries people. Components of salary and benefits which are exempted from payment of tax. Approaches to create salary structures to minimize the tax liability. Procedure for deduction and remittance of taxes. Responsibilities of employer and employee in complying with taxation law.

Practical components:

- Students have prepare questionnaire for conducting wage survey and carry out wage survey for any selected sector and prepare a report for the same.
- Students are expected to conduct a survey regarding the effective utilization of resources within the campus and find out the flaws in the existing compensation system.
- Give a wage determination case and ask the students to suggest solution.
- Give a cost to company case and ask the students to role play for negotiating with a prospective job applicant to distribute the CTC under various components.
- Give a case to Identify and prepare the, notices to be displayed, returns to be submitted and the registers to be maintained as per the above legislations.

RECOMMENDED BOOKS:

1. Compensation- Milkovich G. T, Newman J .M, & Venkata Ratnam C. S., McGrawhill Irwin, 2009.
2. Compensation Management - Deb Tapomoy, Excel Books, 2009.
3. Employee Reward - Michael Armstrong, Universities Press, 2007.

REFERENCE BOOKS:

1. Strategic compensation - Martocchio J. J. Pearson Education, 2004.
2. Compensation - Gerhart B & Rynes S L, Sage Publishers, 2003.
3. Understanding Wages and Compensation Management – Sarma A. M, HPH.

LEARNING AND DEVELOPMENT

Sub Code: 12MBAHR343	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (5 Hours)
Introduction to training and development: Meaning and significance, theories of adult learning, pedagogy and andragogy, classification of learning capabilities, Bloom's taxonomy, Learning enhancement factors, facilitation theory, nine events of instruction, different approaches to adult learning

Module II (5 Hours)
Training Needs Analysis : Meaning and significance of training needs, types of needs, components of needs, data collection, analysis and interpretation.

Module III (5 Hours)
Training Design and Development : Meaning and significance, principles of training design, design process, identifying the training objectives, determining structure, content, duration, method, learning activities, follow up activities and lesson plan

Module IV (5 Hours)
Training implementation: Meaning and significance of implementation, making or buying decision, selecting the training provider, implementation of in-house programme, blocking the dates, mobilizing the resources, logistic requirements, boarding and lodging facilities, identification of trainers, managing contingences, accommodating the changes.

Module V (6 Hours)
Training Evaluation: Meaning and significance of training evaluation, Donald Kirkpatrick's Evaluation Model, Return on investment in Training, data collection for training evaluation, designs of training evaluation.

Module VI (10 Hours)
Teaching and facilitation skills: Competencies for trainers, personal conduct, social practices and subject expertise, handling questions, feedback skills, motivating the trainees, managing time, maintaining decorum, drawing attention, handling post lunch session, frames of reference, communication skills, eye contact, facial expression, gestures, distance zones, presentation and facilitation skills.

Module VII (8 Hours)
On the job methods: Meaning and significance of on the job training(OJT), historical evolution, Allen's four step model, Kane's seven step model, five

needs of supervisors, advantages and limitations of OJT, skills of OJT trainers, OJT process, OJT methods and OJT effectiveness.

Module VIII

(12 Hours)

Other methods: Classroom methods: Meaning and significance of classroom training, advantages and limitations, bringing life to classroom, fundamentals of classroom effectiveness, types of classrooms, methods of classroom learning, technology based classrooms, interaction techniques. **E-Learning methods:** Meaning and significance of e learning, process of e-learning, types of e-learning, advantages and limitations of e-learning. **Outward bound methods:** Meaning and significance of outward bound learning (OBL) methods, process of OBL, risk, safety and ethical issues.

Practical component:

- Students can prepare skill matrix for few selected jobs and identify the types of training needed to impart those skills
- Students can be given case studies/ role plays to understand how these methodologies can be effectively used for training
- Students are expected to conduct a mock training session including need identification and a set of students to evaluate the effectiveness of the same.
- Give a training needs analysis case and ask the students to find out the training needs.
- Ask the individual students to play a role for about 15 minutes to show their teaching and facilitation skills as trainers.

RECOMMENDED BOOKS:

1. Training and Development, Pandu Naik G, Excel Books, 2007.
2. Employee Training & Development – Noe A. Raymond, McGraw Hill, 2008.
3. Training and Development - Janakiram B, Biztantra, 2007.

REFERENCE BOOKS:

1. Effective training Systems, strategies and practices – Blanchard, 2/e, Pearson education.
2. Training for development– Rolf Lynton & Udai Pareek, Sage Publications, 2011.
3. Effective HR Training Development Strategy – Ratan Reddy, HPH, 2005.
4. Training in organizations - Goldstein, 4/e, Cengage learning.

LABOUR LAW AND EMPLOYEE RELATIONS

Sub Code: 12MBAHR344	IA Marks	: 50
No.of Lecture Hrs/week : 04	Exam Hrs.	: 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks	: 100
Practical Component : 01 Hr/ Week		

Module I **(4 Hours)**
Evolution of Labour Law and Industrial Relation: History of labour movement in India, Constitutional provisions of labour law, Labour Commissions and their recommendations.

Module II **(4 Hours)**
International Labour Organization and its role, tripartite approach to industrial relation- Employee unions, Employer unions and Labour department of the government.

Module III **(4 Hours)**
Collective bargaining and negotiation: Collective bargaining and negotiation of service conditions, Non unionized organizations and industrial relation with non unionized workers.

Module IV **(10 Hours)**
Law Relating to Service conditions: Factories Act 1948, Karnataka Shops and Commercial Establishment Act 1961, Contract Labour (Regulation & Abolition) Act 1970, Apprentice Act 1961.

Module V **(10 Hours)**
Law Relating to Social Security Benefits: Employees State Insurance Act 1948, Employees Compensation Act 1923, Maternity Benefit Act 1961, Employees Provident Fund and Miscellaneous Provisions Act 1952, Payment of Gratuity Act 1972,

Module VI **(10 Hours)**
Law Relating to Industrial Relation: Trade Union Act 1926, Industrial Employment (Standing Orders Act) 1946, Industrial Disputes Act 1947.

Module VII **(10 Hours)**
Law and procedure for employee discipline: Meaning and significance of employee discipline, service rules and standing orders, misconduct, suspension and subsistence allowance, show cause notice, investigation, enquiry and charge sheet, principles of natural justice and enquiry procedure.

Sections 11A, 17B, 33 and schedule 5 of Industrial Disputes Act and Section 10A of Industrial Employment standing orders Act.

Module VIII

(4 Hours)

Prevention of Sexual harassment at workplace: Meaning and significance, Supreme Court verdict in Vishaka Versus State of Rajasthan case, employer responsibility to create harassment free work place, training employees for good behavior, modifying service rules to include sexual harassment as misconduct. Punishing the perpetrator and protecting the victim.

Practical Components:

- Arrange a debate on constitutional provisions of labour law.
- Give a case of collective bargaining and ask the students to role play.
- Give an industrial disputes case pending before conciliation officer and ask the students to prepare the written reply of the employer for the said case,
- Arrange a debate in the classroom about rights and duties of trade union of workers. Ask the students to draft a standing order for certification for a newly started garments factory employing 300 workers.
- Give a list of allegations reported against an employee of an organization and ask the students to draft the charge sheet.
- Ask the students to prepare a policy document to prevent sexual harassment at workplace.

RECOMMENDED BOOKS:

1. Relevant Acts with Rules – Reputed Law book publishers.
2. Industrial Relations, Trade Unions and Labour Legislation - Sinha P R N, Sinha I. B and Shekhar S. P, Pearson education, 2010.
3. Industrial Relations and Labour Laws - Srivastava S. C, 5/e, Vikas Publishing, 2010.
4. Industrial Relations and Labour Law - Singh B.D, Excel Books, 2011.

REFERENCE BOOKS:

1. Industrial and Labour Legislation - Porwal L. M. and Sanjeev Kumar, Vrinda Publications, 2010.
2. Industrial Relations - Ratna Sen, Macmillan Publishers, 2010.
3. Industrial Jurisprudence and Labour Legislation, Sarma A. M, 5/e, HPH.

SEMESTER III: CREATIVE MANAGEMENT AREA

IDEATION, BRANDS AND BUSINESS

Sub Code: 12MBACM351	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)

Definition of an Idea; what is the construct of an Idea; how best to identify & describe an Idea; what makes an Idea sustainable & growing; basic principles of Ideation; recognizing & nurturing Ideas; impact of culture, history, language & folklore on Ideas, The Idea in Art, Ideas in Nature, Ideas in Science, What are the Best Ideas of the 20th Century? Articulating the problem, How to look at ideas as problem solvers?

Module II (6 Hours)

Ideas across domains like FMCG, durables, services, corporate & individual branding; translation of the principles across B2C, B2B, G2C & P2P; implications in non-traditional marketing fields like charity, spirituality & politics; do's & don'ts of Ideation across all situations, The Origin of the Word – Brand, Difference between a Product and a Brand, The Connection between a Brand and its Advertising, Brand Ideas as Owned or Seen by Consumers.

Module III (6 Hours)

What is an Advertising Positioning? How to write a Creative Brief? The need to articulate the Idea and how to ensure its expression across multi-media? Carrying an Idea to flawless execution; selling an Idea – Conflict Resolution and the Art of Compromise, Wit in Advertising and Design, Shades of Humour and Indian and Global Culture.

Module IV (8 Hours)

Implications across different touch points & tasks & budgets; execution mandatories; techniques for Idea generation & evaluation; Mind Mapping, Brainstorming, Random Association, Problem Reversal, Forced Analogy, Assumption Smashing, Attribute Listing, Lateral Thinking, 100 Boxes, Hive Mind; Six Thinking Hats; Branding touch point # 1---Brand name & its packaging & its logo & its colors & its font.

Module V**(8 Hours)**

Branding touch point---The channel & placement & retail; Modern trade versus kirana; The role of the channel and brand pull; Monitoring and Managing Channels; Branding touch point # 3---The Strategic role of Pricing; Price and Consumer profile and Brand image. Branding touch point # 4---Brand promotion including PR. Brand Positioning, Brand Positioning Process, Product Positioning Process, Brand Positioning and the Consumer Mind

Module VI**(6 Hours)**

The role of media mix and tapping the inherent synergy; The ROI of promotions; The inter-play between Marketing & Sales & Distribution & After-sale service & Operations & manufacturing; The Role of New Media in Brand Promotion, Direct Marketing, Interactive Marketing, Personal Communication; Market Entry Method, Licensing and Franchising, and Contracting, Non-profit Marketing

Module VII**(8 Hours)**

Strategic Brand Management; Brand portfolios; Brand extensions; Sub-brands; Mother brands; Umbrella brands; Brand Integration Strategy; Brand folk-lore & Myths & Icons; Brand disasters & Revitalizing & refreshing brands; The emerging philosophy of Brand influence and Brand Advocacy; How can brands have meaningful & exciting & mutually advantageous conversations with their current & prospective consumers?

Module VIII**(8 Hours)**

The impact of technology & Internet & social networks; New media and brand-consumer relationships; Promiscuity on the rise---brand switch at the click of the mouse; The resulting lowering of exit barriers & vanishing of geographic borders; Global and Local Brand Management; The Impact of Technology and Internet and Social Networks; Search Engines Impact and Perception of Brands; Blog Impact on Brands.

Practical Components:

- Look for 5 unique & highly persuasive ideas around you and imagine what would have been the underlying consumer need that these ideas seek to solve.

- Survey 6 service brands---3 successful & 3 failures and identify through a field study among their users the reasons for their success & failure.
- Write an essay on the similarities & differences among brands & their ideas in rural vs urban markets.
- Do a secondary research about the global & Indian experiences of the impact of ideas on men vs. women.
- Identify 5 recent advertising campaigns and articulate what would have been their tasks, the insights, the ideas & their creative expression along with the choice of media.

RECOMMENDED BOOKS:

1. How to have Kick-ass Ideas - Chris Barez- Brown, Sky Horse Publishing, 2008.
2. A Whack on the Side of the Head, Creative Think - Roger Van Oech 1/e, 1973.
3. Lateral Thinking - Edward de Bono, Harper Colophon, 1973.
4. Six Thinking Hats - Edward de Bono, Penguin India, 2010.
5. How to Have Creative Ideas - Edward de Bono, Vermilion, 2007.
6. A Technique for Producing Ideas - James Webb Young, National Textbook Co.

REFERENCE BOOKS:

1. The Riddle - Andrew Razeghi, Times Books, Bennett Coleman, 2008.
2. A Terrible Beauty: The People and Ideas that Shaped the Modern Mind - A History - Peter Watson, Weidenfeld & Nicolson History, 2001.
3. How to think Like Leonardo da Vinci, Gelb, Michael J, Harper, 2008.
4. Mind Mapping, Plume , 1996
5. Teaching Thinking - Edward de Bono, Penguin, 1976.
6. Textbook of Wisdom - Edward de Bono, Penguin, 1994.
7. Intelligence is Not Enough - Edward de Bono , Westland, 2007.
8. The Handbook of New Media - Leah A. Lievrouw, Sonia Livingstone (ed.), SAGE, 2002
9. Understanding New Media: Extending Marshall McLuhan, Logan, Robert Peter Lang Publishing. 2010.
10. The New Media Reader - Wardrip-Fruin, Noah and Nick Montfort, ed. The MIT Press. 2003.
11. Media Society: Industries, Images and Audiences, Croteau and Hoynes. 3/e, Pine Forge Press: Thousand Oakes. 2003.

ENGAGEMENT PLANNING AND NEW MEDIA

Sub Code: 12MBACM352	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (8 Hours)

Introduction to basic concepts like media reach, frequency; effective reach & OTS; GRPs & CPRP; Relationship between Media and Audience; Offering Choices---Media and Advocacy; Media and Propaganda; Public Relations & Media; Types of Audiences; Effects of Media; Effects of Media in Day-to-Day Life; Media's Effects on Attitudes and Opinions.

Module II (8 Hours)

The concepts of media exposure; media mappings; media mix; media apertures; media intensity & media stickiness; Learning from Media, Digital Media Effects; Convergence of Media; Offering Choices---Media and Advocacy, Media and Propaganda, Public Relations & Media.

Module III (6 Hours)

Similarities & differences between traditional & new media; the implications for brand building; innovations in planning, budgeting, executing, reporting & evaluating multi media campaigns; Changing Patterns of Media Consumption Habits

Module IV (4 Hours)

New media & consumers; the shifting nature of the relationships between them; push vs pull media; role of technology in these.

Module V (8 Hours)

What is truly inter-active media Difference between media in the traditional sense & new thinking in terms of engagement; Integrated Media; What Makes Integration Successful? - Fit, focus, fame, Permission Marketing, Reality Marketing, Experiential Marketing, Branded Content and Sponsorship – What's The Difference?

Module VI (6 Hours)

media as interface & channel of brand relationship building; opportunities &

challenges in case of traditional vs new media; strategic implications for brand building; Fragmentation of Media and Implications for Media Planning and Buying

Module VII

(8 Hours)

User generated content; Implications of User Generated Content; media neutrality; media credibility; source authority; blogs vs twitter vs face book vs google vs yahoo; Punk Marketing, Word of Mouth and Subversive User Content, Cross-platform User Content.

Module VIII

(8 Hours)

Types of Media Bias, Media Neutrality in India, Commercialization/ Commodification of Values in Media, Advertorial, Media Literacy and Media Neutrality; Media metrics & measurement both from planning & buying perspectives; ROI for traditional vs. new media; implications for budgeting & campaign planning & MIS; Branded Content: From Placement to Entertainment – Advertainment, Looking to the Future, Extending the Reach of Branded Entertainment.

Practical Components:

- Do a project on the impact of twitter on brand building using successful as well as weak brands.
- Interview 5 marketers about their current & intended strategies to exploit social media and make a presentation to a panel of these companies.
- Identify the daily media calendars for 3 different audiences---successful male corporate executive; middle class home maker; teenagers—either sex.
- Do a survey about the impact of technology on television---the challenges & opportunities.
- Do a comprehensive secondary research – global & Indian – On how print media can monetize their content without going bankrupt, in an era where the consumers are most unwilling to pay for any content online. Make a presentation of your findings to a panel of local print media owners

RECOMMENDED BOOKS:

1. Ogilvy on Advertising - David Ogilvy, First Vintage Books edition, 1985
2. No Logo - Naomi Klein, Picador; Tenth Anniversary Edition. ,2009

3. The Substance of Style - Virginia Postrel, Perennial, 2004
4. Cutting Edge Advertising - Jim Aitchison, Pearson Education Canada, 2008
5. Cutting Edge Commercials - Jim Aitchison, Prentice Hall, 2008

REFERENCE BOOKS:

1. The Advertising Concept Book - Pete Barry ,Thames and Hudson, 2008.
2. Twenty Ads That Shook the World - James Twitchell, Three Rivers Press, 2001.
3. Visual Communication - Paul Martin Lester, 5/e, Wadsworth Publishing , 2004.
4. UnSpecial Effects - Bob Gill, Graphis (NY), 2001.
5. Creative Advertising - Mario Pricken, Thames and Hudson, 2008.
6. The Fifth Discipline Fieldbook - Peter M. Senge, Doubleday/Currency, 2006.
7. The History of Arts – Gombrich E. H and E.H. Gombrich E.H. Gombrich,1980.
8. Authenticity - David Boyle, Flamingo, 2003.
9. The Millennials Rising: The Next Great Generation - Neil Howe, William Strauss and R.J. Matson, 1/e, Vintage , 2000.

PROJECT MANAGEMENT AND BUDGETING

Sub Code: 12MBACM353	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(6 Hours)

Project management: concepts & key terms, evolution of integrated project management system, aligning projects with organization strategy; Introduction to key concepts: project characteristics Emerging International trends; Project scheduling: Gantt chart, Pert- ADM Networks, and three time estimation.

Module II

(6 Hours)

Effective project portfolio management system, project life cycle, feasibilities of projects-different forms of project contracting; Resource Allocation – Resource estimation, allocation & Leveling.

Module III (6 Hours)
Project Scope management & Budgeting: defining project scope, creating work break down structure (WBS); Project cost estimation methods; project budgeting and cost breakdown structure (CBS)

Module IV (6 Hours)
Project roll up; process break down structure; responsibility matrix; Project Monitoring and control: assessment of current status of activity completion and updating, details and frequency of reporting, system of weighted average completion

Module V (8 Hours)
Project scheduling and Risk Management: network models, PERT & CPM using software; Project performance evaluation : ‘S’ curves for project completion and cost comparison Concept of earned value, cost and schedule performance indices, estimates at completion

Module VI (8 Hours)
Measuring risk; Contingency planning; scheduling resources; reducing project duration; Project performance evaluation: ‘S’ curves for project completion and cost comparison; Concept of earned value, cost and schedule performance indices, estimates at completion

Module VII (8 Hours)
Project Team Management: building high-performance project teams, managing virtual project teams, project control process; Basic essential and desirable features for Project management packages; assessing and evaluating organizational needs and matching of features; overview of different packages available; demonstration of the use packages

Module VIII (8 Hours)
Performance measurement and evaluation, project quality, planning, quality assurance, quality audit, project closure, post completion audit; Project procurement and contract management: Project purchasing – special characteristic, material controls, codification and storage

Practical Components:

- Take 3 regular college based events e.g. Annual day; cultural festival and the convocation, and do a full fledged project plan for these and “sell” them to the college authorities.
- Take 5 family projects like an annual holiday; religious festival and birthdays and apply the principles of budgeting to these.

- Take a local festival or a sports tournament and demonstrate to the organizers the benefit of scientific project management.
- Take any project of your choice, including social development, and successfully complete an end-to-end planning to implementation. Then share the lessons learnt on the challenges & your strategy to overcome these to a panel of external NGO's.

RECOMMENDED BOOKS:

1. The Wiley Project Engineer's Desk Reference: Project Engineering, Operations, And Management - Sanford I. Heisler, Heisler, Wiley-interscience,1994.
2. Fundamentals of Project Management - James P Lewis, Heritage Publishers, 20f03.
3. Managing Projects Large and Small: The Fundamental Skills to Deliver on budget and on Time - Harvard Business Press, 2003.
4. An Introduction to IT Project Financials - Budgeting, Cost Management and Chargebacks - Michael Gentle, Lulu. Com, 2010.

REFERENCE BOOKS:

1. Project Management: a Reference for Professionals: Cost Engineering - Robert L Kimmons, James H Loweree, CRC Press. 2000.
2. Project Management: The 12 Predictable and Avoidable Pitfalls Every Project Faces, Happy About, - Kimberley Wiefeling, Scrappy 2003.
3. Earned Value Project Management - Quentin W. Fleming, Project Management Institute, 2009.
4. Project Management Accounting: Budgeting, Tracking, And Reporting Costs And Profitability - Kevin R. Callahan, Gary S. Stetz, Lynne M. Brooks, John Wiley & Sons, 2007.
5. Project Management: Getting The Job Done On Time And In Budget - Patrick L. Healy, Patrick Healey, Butterworth Heinemann Limited, 1998.
6. Project Management – Vasant Desai, HPH.

MARKET RESEARCH AND INSIGHTS

Sub Code: 12MBACM354	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (8 Hours)

Market Research and Marketing Research, Types of Market Research, Qualitative Research and Quantitative Research, Decisions that can be Guided by Market Research, Importance of Marketing Research, Consumer Insight, Divisions of Marketing Research Market Research, Advertising or Promotion Research, Product Research, Distribution Research, Sales Research, Marketing Research and Marketing Management

Module II (8 Hours)

The Marketing Research Process, Commissioning Market Research, Research Brief, Marketing Information System, Components of Marketing Information System, Internal Reports System, Marketing Research System: Marketing Intelligence System, Analytical Marketing System; Competitive Intelligence, Common Errors in Using Competitive Intelligence, Decision Making

Module III (8 Hours)

Importance of Marketing Research in Business, Marketing Research and Decision Making, the Characteristics of Valuable Information, Types of Marketing Research Studies, Stages in the Research Design Process, Quantitative Research Sampling, Measurement Techniques, Attitude Measurement, Self-Reporting Methods, Methods for Rating Attributes

Module IV (6 Hours)

Measurement Techniques: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale; Scale Types: Comparative Scaling, Non-comparative Scaling; Attitude Measurement, Self-Reporting Methods, Methods for Rating Attributes, Data Analysis, Customer Research, Advertising Research, Product Research, Distribution Research, Sales Research, Marketing Environment Research, Internet Marketing Research, and International Marketing Research

Module V (7 Hours)

Qualitative Market Research, Types of Qualitative Market Research, Newer and Emerging Qualitative Researches, Morphological Psychology and Market Research, When to Employ Qualitative Research; Ethics and Qualitative Market Research; Case Studies for Qualitative Research.

Module VI**(7Hours)**

Qualitative Research Employed and It's Suitability, Types of Observational Research, Advantages and Disadvantages of Observational Research, Ethnography, Explicit – Implicit Triggers, Researching Values – Attitude – Behaviour; Analysis of Information, Outcomes, Research Reports and Presentations, Direction for Management, Findings Interpretation

Module VII**(8 Hours)**

What is an insight and where are the available and how to search for them? The Role of an Insight in Product Development and Marketing; Marketing Research and Marketing Management, The Marketing Research Process, Commissioning Market Research, Research Brief, Developing the Research Plan, Market Research for Small Businesses; Research process at each stage – brief, design, execution, and interpretation;

Module VIII**(4Hours)**

Research trends, Behavioural Science Based Approach, Economic and Competitive Pressures, Consumer Insight Groups, Quantifying Emotions, Impact of the Social Media, Do-it-Yourself (DIY) Research; Research ethics, typical research errors, Research and culture;

Practical Components:

- Choose 5 successful products or services and identify the insight behind them through a field survey.
- Do a comprehensive essay on the difference between consumer vs. trade vs. competition insights & how best to exploit them.
- Take 5 recent digital innovations e.g. twitter or facebook and identify the insights. Locate 5 non-users of search or mail and interview their reasons.
- Choose 5 recent successful campaigns and identify their insights through consumer interviews. Present your findings to the class
- Choose 3 successful movies eg. Dabang & Zindagi na milegi & My name is Khan--and interview consumers about the reasons for their success. Similarly repeat this with 3 recent expensive flops. Present your findings to the class

RECOMMENDED BOOKS:

1. Ethnographic Research: A Guide to General Conduct - Ellen R. F, Academic Press, 1987.
2. Essentials of Marketing Research – 4/e, Tony Proctor, PHI, 2005.

3. Essentials of Marketing Research – William G. Zikmund, Barry J. Babin, 4/e, Cengage Learning, 2010.
4. Marketing Management – S. K. Sarangi, 2/e, Asian Books Private Limited, 2009.
5. Research Skills for Students: Transferable and Learning Skills - Allison, B, O’Sullivan, T, Owen, A, Rice, J, Rothwell, A and Saunders, C Kogan Page, 1996.
6. Market Research - Robin Birn, Patrick Forsyth, John Wiley and Sons Inc. 2002.

REFERENCE BOOKS:

1. Ethnographic Research: A Reader - Stephanie Taylor. Sage. 2002.
2. The Observational Research Handbook: Understanding How Consumers Live With Your Product - Bill Abrams and American Marketing Association, Mc-Graw Hill Professional. 2000.
3. Doing Ethnographic and Observational Research - Michael V. Angrosino, Steinar Kvale, Rosaline S. Barbour, Marcus Banks, Graham Gibbs, Tim Rapley, Sage, 2007.
4. Marketing - Paul Baines, Chris Fill, Kelly Page, Oxford University Press, 2008.
5. Marketing: An Introduction - Gary Armstrong, Michael Harker, Philip Kotler, Ross Brennan, Financial Times Prentice Hall. 2009.
6. Marketing: the basics - Karl Moore, Niketh Pareek, Routledge. 2010.
7. Market Research: a guide to planning, methodology & evaluation - Paul Hague, Kogan Page, 1996.
8. Market Research Best Practice. 30 Visions of the Future - Peter Mouncey, Frank Wimmer. John Wiley and Sons Inc. 2007.

SEMESTER IV

SUPPLY CHAIN MANAGEMENT

Sub Code: 12MBA41	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

MODULE 1 (8 Hours)
Introduction to Supply Chain Management
Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing.

MODULE 2 (10 Hours)
Designing the supply chain network
Designing the distribution network – role of distribution – factors influencing distribution – design options – e-business and its impact – distribution networks in practice – network design in the supply chain – role of network – factors affecting the network design decisions – modelling for supply chain.

MODULE 3 (5 Hours)
Designing and Planning Transportation Networks.
Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs – Tailored transportation.

MODULE 4 (8 Hours)
Sourcing and Pricing.
Sourcing – In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment, selection – design collaboration – procurement process – sourcing planning and analysis.
Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

MODULE 5 (5 Hours)
Information Technology in the supply chain
IT Framework – customer relationship management – internal supply chain management – supplier relationship management – transaction management – future of IT.

MODULE 6 (6 Hours)
Coordination in a Supply Chain

Lack of supply chain coordination and the Bullwhip effect – obstacle to coordination – managerial levers – building partnerships and trust – continuous replenishment and vendor managed inventories – collaborative planning, forecasting and replenishment.

MODULE 7 (7 Hours)

Dimensions of Logistics

Introduction: A macro and micro dimension – logistics interfaces with other areas – approach

to analyzing logistics systems – logistics and systems analysis – techniques of logistics

system analysis – factors affecting the cost and importance of logistics.

MODULE 8 (7 Hours)

Demand Management and Customer Service

Outbound to customer logistics systems – Demand Management – Traditional Forecasting –

CPFRP – customer service – expected cost of stockouts – channels of distribution.

Practical Components:

- Students are expected to choose any 2 Indian Organization and study their supply chain in terms of drivers of the Supply chain and submit a report
- Students can study TPL and FPL service providers in India and develop the profile of various services provided by them
- Students can identify any product/service and study the type of distribution system used and understand the reason for using that particular type.
- Students can identify the various types of IT applications employed by Indian Organizations in their Supply chain.

RECOMMENDED TEXT BOOKS:

1. Sunil Chopra and Peter Meindl, Supply Chain Management – Strategy, Planning and Operation, Pearson/PHI, 3rd Edition, 2007.
2. Supply Chain Management by Janat Shah Pearson Publication 2008.
3. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e

REFERENCE BOOKS:

1. Donald J Bowersox, Dand J Closs, M Bixby Coluper, Supply Chain Logistics Management, TMH, Second Edition, 2008.

2. Wisner, Keong Leong and Keah-Choon Tan, Principles of Supply Chain Management A Balanced Approach, Cengage Learning, 1/e
3. David Simchi-Levi et al, Designing and Managing the Supply Chain – Concepts,

TOTAL QUALITY MANAGEMENT

Sub Code: 12MBA42	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 hours)
 Introduction to TQM, Meaning of the terms quality, quality control and quality assurance, importance of quality, quality dimensions of products and services, quality and competitive advantage, cost of quality, TQM, Evolution of TQM, Basic principles of TQM, TQM VS Traditional management, advantages of TQM

Module II (10 Hours)
 Philosophical Framework to TQM Contribution of various gurus of TQM, Deming-Deming's chain reaction, Deming's principles, deadly sins, PDCA cycle, Juran's Quality trilogy, Juran's breakthrough sequence, Philips crosby- Quality is free, Taguchi's Quality loss function, Ishikawa's contributions and Quality Circles.

Module III (6 Hours)
 Benchmarking Definition, reasons for benchmarking, types of benchmarking, process of benchmarking what to benchmark, understanding current performance, planning, studying others, using findings, Xerox model of benchmarking, Advantages and pitfalls of benchmarking Concept of Kaizen and its applications

Module IV (6 Hours)
 Business Process Re-engineering(BPR) Introduction, Need for BPR, Implementing BPR, Steps in BPR, Re-engineering Vs. TQM, BPR Vs. Kaizen, Re-engineering the structure, change management and BPR, BPR and IT, Advantages and Limitations, Indian examples of BPR

Module V (8 Hours)

Quality Management Systems(QMS) Introduction, meaning of QMS, ISO 9000, Benefits of ISO, ISO 9000-2008 series, implementation of ISO 9000, Problems related to ISO 9000, QS 9000, Need for QS 9000, QS 9000 series ENVIRONMENTAL MANAGEMENT SYSTEM (EMS), ISO 14000 series, Benefits of ISO 14000, Integrating ISO 9000 & 14000, SEI-CMM level 5,

Module VI

(6 Hours)

Quality Awards : Introduction, Need for Quality Awards, Deming Prize and its features, MBNQA and its features, European quality award and its features, Golden peacock award, TQM models.

Module VII

(8 Hours)

Quality Control tools: Introduction, 7 tools of quality control (Old & New), Poka-yoke, Quality Function Deployment.

Module VIII

(6 Hours)

Introduction to Six Sigma Historical developments, statistical framework for six sigma, DPU and DPMO concepts, DMAIC methodology, Training for Six Sigma, Benefits of Six Sigma, Six sigma and TQM.

Practical Component:

- Students have to study any Indian organization which has won Deming prize and identify the quality initiatives of that organization
- Students are expected to study various quality awards given in India like CII Business excellence award , Rajiv Ghandi national quality award and Tata groups Excellence Award and compare with international awards
- Students can identify any 2 products and 2 services and develop Quality attributes for the same.
- Students can identify industry from any sector and conduct a benchmark study with respect to best in the class.

RECOMMENDED TEXT BOOKS:

1. Management and Control of Quality, James R. Evans, 8/e 2012, Cengage Learning
2. Total Quality Management, Dale.H. Besterfield, 3rd Edition, Pearson Education
3. Total Quality Management Text and Cases, G. Nagalingappa & Manjunath VS, Excel books.
4. Total Quality Management, Shridhar Bhat, Himalaya Publication

REFERENCE BOOKS:

- 1.Total Quality Management by Poornima M.Charantimath, Pearson Education.
2. Quality Control Handbook by JURAN, Mc.Graw Hill Publication

SEMESTER IV: MARKETING AREA**RURAL MARKETING**

Sub Code: 12MBAMM415	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (4 Hours)

Introduction: Definition, scope of rural marketing, concepts, components of rural markets, classification of rural markets, rural vs. urban markets

Module II (8 Hours)

Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure patter, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, problems in rural marketing, rural demand, rural market index, Agriculture Inputs(Seeds, Fertilizers, Farm Machineries)

Rural credit institutions: Role of cooperative institutions, regulated markets, agriculture export zones(AEZ).Establishments of marketing departments for various agricultural and non-agricultural produce. KAPPAC, COIR BOARD, COFFEE BOARD, NHB, APEDA.

Module III (6 Hours)

Rural Consumer behaviour: Consumer buying behaviour models, Factors affecting Consumer Behaviour, Social factors, Technological Factors, Economic Factors, Political Factors,

Characteristics of Rural consumer- Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and pre purchase Evaluation, Rise of Consumerism,

Consumer Buying Process, Opinion Leadership Process, Diffusion of Innovation, Brand Loyalty

Module IV

(6 Hours)

Researching Rural Market: Sanitizing rural market, Research design-Reference frame, Research approach, Diffusion of innovation, Development studies, PRA approach, The need for PRA, Sampling, Operational aspects of data collection,

Module V

(9 Hours)

Rural Marketing Strategies:

a) Segmenting, Targeting and Positioning

Segmentation- Heterogeneity in Rural, Prerequisites for Effective Segmentation, Degrees of Segmentation, Basis of Segmentation and Approaches to Rural Segmentation- Geographic Segment, Demographic Segmentation, Psychographic Segmentation, Behaviour Segmentation, Multi-attribute Segmentation,

Targeting- Evaluation and Selection of Segments, Coverage of Segments,

Positioning- Identifying the positioning Concept, Selecting the positioning Concept, Developing the Concept, Communicating the Concept

b) Product Strategy: Introduction, Marketing Mix Challenges, Product concepts classification- Five Levels Products, Classification of Products, Rural Product Categories – Fast moving Consumer goods, Consumer Durables, Agriculture Goods, Services,

c) New Product Development: Consumer Adoption Process, Product life cycle, Product Mix,

d) Branding in Rural India- Brand building in Rural India, Brand Spectrum in Rural, Brand Loyalty Vs Stickiness

e) Fake Brands- The Fakes Market, Strategy to counter fakes,

Structure of competition in Rural India, Product warranty and After-sales-service, Conclusion, Assignment

Module VI

(7Hours)

Distribution Strategy: Introduction: Accessing Rural Markets, Coverage Status in Rural Markets, Channels of Distribution, Evolution of Rural Distribution Systems- Wholesaling, Rural Retail System, Vans, Rural Mobile Traders: The last Mile Distribution, Haats/Shandies, Public Distribution System, Co-operative Societies Behaviour of the Channel, Prevalent Rural Distribution Models- Distribution Models of FMCG Companies, Distribution Model of Durable Companies, Distribution of fake products, Emerging Distribution Models- Corporate –SHG Linkage, Satellite Distribution, Syndicated Distribution, ITC's Distribution Model, Petrol pumps and Extension counters, Barefoot agents, Agricultural agents, Agricultural input dealers, Other channels, Ideal distribution model for Rural

Module VII

(6 Hours)

Communication strategy:Challenges in Rural Communication, A view of Communication Process, Developing Effective- Profiling the Target Audience, Determining communication objectives, designing the message, selecting the communication channels, deciding the promotion mix, Creating advertisement for rural audiences rural media- Mass media, Non-Conventional Media, Personalised media, Rural Media: The importance of the two-step flow of communication Media Typology, The Media Model, Media innovation, Influence of Consumer Behaviour on Communication strategies,

Module VIII

(6 Hours)

The future of Rural Marketing: Introduction, Focused Marketing Strategies, Market Research, Consumer Finance, Rural Vertical, Retail and IT Models, Rural Managers, Glamorize Rural Marketing, Public-Private

Case studies in Indian context only

(4 Hours)

Practical Components:

- Visit to the various Micro Finance Institutes, who extend their services in catering rural market.
- Approaching the FMCG companies which have already catered in Rural and Understand the approach strategy (What is that innovative concept the company has adopted in successfully catering in to rural markets)
- Visit to a village and APMC to understand the market structure and also understand the functioning part of the rural markets
- Students should come up with new product designing with the rural marketing mix 4 As (Awareness, Acceptability, Adaptability and Affordability)
- Students can do a survey on purchase pattern of automobiles or telecom products or any other smart gadgets.
- Students can Visit and do a survey on corporate farming and its effect on income of the rural farmer.

RECOMMENDED BOOKS:

1. Rural Marketing - Pradeep Kashyap & Siddhartha Raut, Biztantra
2. Rural Marketing - Gopal Swamy T. P, 3/e, Vikas Publishing House,
3. Rural Marketing - Dogra & Karminder Ghuman, 1/e, TMH.
4. Rural Marketing - Sanal Kumar Velayudhan, 2/e, Response SAGE Publication 2007.
5. Rural Marketing – Badi, HPH.

REFERENCE BOOKS:

1. Rural Marketing – Mathur U. C, 1/e, excel books.
2. Rural Marketing – Krishnamacharyulu C. G & Lalitha Ramakrishnan, Pearson Education.
3. Rural Marketing – Habeeb Ur Rahman,1/e, HPH, 2004.
4. Rural Marketing – Sukhpal Singh , Vikas Publishers

5. Rural Marketing – Minouti Kamat & R. Krishnamoorthy, 3/e, HPH.
6. Agricultural Marketing In India – Acharya , Oxford I B H
7. Advertising & Marketing in Rural India- Tej K. Bhatia, 2/e, Macmillan.
8. Marketing of Agricultural Products - Richard Kohls and Joseph N. Uhl, 9/e, PHI.

STRATEGIC BRAND MANAGEMENT

Sub Code: 12MBAMM416	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I– Introduction To Branding: (8 Hours)

Historical Origins Of Branding. Definition Of Brand. Why Do Brands Matter To Consumers And Producers. Branding Of Physical Goods, Services, Retailers And Distributors, People, Organizations, Sports, Arts, And Entertainment, Geographic Locations Etc. Branding Challenges And Opportunities.

Module II : Measuring Brand Equity: (8 Hours)

Definition. Cost Based Method. Price Based method. Customer based brand equity.

Module III: Choosing Brand Elements (7 Hours)

Definition and criteria for choosing brand elements. Options and tactics for Brand names, URL's, Logos and symbols, Characters, slogans, jingles, packing and putting it all together.

Module IV: Brand Positioning: (7 Hours)

Product positioning. The three C's of positioning. Competitive positioning. POP'S AND POD's. Positioning Strategy.

Module V: Other Branding Concepts: (6 Hours)

Brand Personality- Meaning & Definition, Types of Brand personalities, Elements of Brand personality

Brand Image- Meaning & Definition, Sources of Brand Image, Brand Image for Established and New Products, Brand Image & Celebrity

Brand Knowledge: Meaning, Dimensions, and conceptualizing the leverage process using company, countries, channels, other brands, characters, events etc

Module VI: Branding Strategies **(7 Hours)**

Brand Extension- Meaning, Types, Needs, Advantages & Disadvantages of Brand Extension. How do customers value Brand Extension. Evaluating Brand Extension Opportunities.

Brand Repositioning: Meaning, Types of repositioning strategies in Indian marketing

Module VII: Brand Imitations: **(5 Hours)**

Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.

Module VIII– Making Brands Go Global: **(6 Hours)**

Geographic extension, sources of opportunities for global brand, Single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization , Managerial blockages, organisation for a global brand, pathways to globalization.

Case studies in Indian context only **(2 Hours)**

Practical Components:

- Go to a supermarket and find the brand elements in various brands of soaps, mobiles, jeans, and other products
- If you would start an MBA College, what would the positioning be with POP's and POD's?
- Pick up your college, analyse its positioning and how would you reposition it?
- Pick a multiproduct company and as completely as possible analyse its brand portfolio and brand extensions ?
- Consider some groups like Tata's , Birla's, Infosys etc – what is their branding strategy

- Student can carry out a study on Celebrity endorsement by visiting the brand building house like lowe lintas regarding the Brand promotion.

RECOMMENDED BOOKS:

1. Strategic Brand Management: Building Measuring & Managing Brand Equity – Kevin Lane Keller, 3/e, Pearson Education, 2011.
2. Brand Management: The Indian Context - Moorthi Y L R, Vikas Publication.
3. Strategic Brand Management – Kapferer, JeanNoel, 2/e, Kogan Page.
4. Brand Imitations – Kaptan, Pandey S, 1/e, HPH, 2004.
5. Brand Management - Tapan Panda, 2/e, Excel Publication.
6. Brand Management : Text and Cases, U C Mathur, 1/e, Macmillan.

REFERENCE BOOKS:

1. Brand Management- Harish V. Verma, 2/e, Excel Books.
2. Compendium Brand Management – Chunnawalla, 1/e, HPH, 2003
3. Managing Indian Brands –Ramesh Kumar S, Vikas.
4. Strategic Brand Management- Richard Elliott & Larry Perclu, 1/e, Oxford Press
5. Creating powerful brands – Chernatony, 1/e, Elsevier Publication.
6. Successful Promotions Build Successful brands – Pran K. Chodhury, University Press

INTEGRATED MARKETING COMMUNICATIONS

Sub Code: 12MBAMM417	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(8 Hours)

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model.

Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications

Purpose, Role, Functions, Types, Advertising Vs Marketing mix, Advertising appeal in various stages of PLC

Module II (4 Hours)
Advertising Agency: Type of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation.

Module III (4 Hours)
Advertising objectives and Budgeting: Goal setting – DAGMAR approach, Various budgeting methods used.

Module IV (8 Hours)
Media planning: Developing Media plan, Problems encountered, Media Evaluation-Print, Broadcast media, Support media in advertising.
Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy.

Module V (8 Hours)
Direct Marketing: Features, Functions, Growth, Advantages/Disadvantages, And Direct Marketing Strategies.
Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push pull strategies, Co-operative advertising, Integration with advertising and publicity
Public relation/ Publicity:- Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR Vs Publicity.

Module VI (4 Hours)
Monitoring, Evaluation and control: Measurement in advertising, various methods used for evaluation, Pre-testing, Post testing.

Module VII (11 Hours)
International Advertising: Global environment in advertising, Decision areas in international advertising
Internet advertising: Meaning, Components, Advantages and Limitations, Types of Internet advertising
Industrial advertising: B 2 B Communication, Special issues in Industrial selling.

Module VIII (5 Hours)
Event Management: Introduction Purpose of organizing an Event, Key elements of Events, Concepts of promotion and pricing in events.

Case studies in Indian context only (4 Hours)

Practical Components:

- Study the IMC programs adopted by various colleges to students applying for an MBA course? Is the tactic adopted by your college right? If no, what are your suggestions?
- Study the role of newspapers, radio, television, billboards, internet and other media in the marketing of mobiles. cold drinks, jeans, mobiles etc.
- Observe a marriage in your family and write about how you would 'event manage' it?
- Take an advertisement introducing a new product like soap, biscuit etc and find the media in which it was advertised. Ask your friends if they can recall this advertisement and the message. Analyse if they would or would not buy the product on the basis of this advertisement? And why?
- Students can do a survey on effective media communications.

RECOMMENDED BOOKS:

1. Advertising and Promotions IMC Perspectives: Belch and Belch – Tata Mc Graw Hill, 9/e, 2012.
2. Advertising 'An IMC Perspective' - S. N. Murthy / U.Bhojanna - Excel Books, 2007.
3. Advertising & Integrated Brand Promotion - O'Guinn, Allen, Semenik, Cenage Learning.
4. Integrated Advertising, Promotion, and Marketing Communications, Clow, Baack, 3/e, Pearson Education, 2007.
5. Integrated Marketing Communications – Niraj Kumar, HPH.

REFERENCE BOOKS:

1. Foundations of Advertising, Chynawalla & Sethia, HPH, 2007
2. Advertising management - Rajeev Batra, John G Myers & Aaker, 5/e, PHI, 2007.
3. Event marketing and management- Sanjaya Singh, Vikas Publication, 2003.
4. Advertising Basics, Vilanilam, Varghese, Response Books, 2007
5. Advertising, Sangeeta Sharma & Raghuvir Singh, PHI, 2006.

INTERNATIONAL MARKETING MANAGEMENT

Sub Code: 12MBAMM418	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (7 Hours)

Framework of international marketing: Definition – scope and challenges – difference between international marketing and domestic marketing – the dynamic environment of international trade – transition from domestic to international markets – orientation of management and companies

Global e-marketing: The Death of Distance, communications, Targeting the individual customers, relationship marketing, interactivity, Speed to market, living in an age of technical discontinuities, new technologies change the rules of competition, components of the electronic value chain.

Module II (8 Hours)

Developing a global vision through marketing research: Breadth and scope of international marketing research – problems in availability and use of secondary data – problems in gathering primary data – multicultural research – a special problem – research on internet – a new opportunity – estimating market demand – problems in analyzing and interpreting research information – responsibility for conducting marketing research – communicating with decision makers. Identifying foreign markets – classification based on demand – based on the stage of development – other bases for division of world markets

Social and Cultural Environment: Basic aspects of society and culture, Approaches to cultural factors, Impact of Social and Cultural Environment on Marketing Industrial and Consumer Products

Module III (7 Hours)

Global marketing management – planning and organization: Global perspective – global gateways – global marketing management – an old

debate and a new view – planning for global markets – alternative market entry strategies – organizing for global competition

Module IV

(6 Hours)

Products and services for consumers: Quality – Green marketing and product development, products and culture – analyzing product components for adaptation– products for consumers in global markets, product development, product adaptation, product standardization, marketing consumer services globally – marketing of services, brands in international markets

Products and services for businesses

Demand in global business to business markets – quality and global standards – business services – trade shows' crucial part of business to business marketing – relationship markets in business to business context

Module V

(8 Hours)

Licensing, Strategic Alliances, FDI: Introduction, Licensing, Strategic Alliances, Manufacturing Subsidiaries, Entry Modes and Marketing Control, Optimal Entry Strategies.

Global Distribution

Introduction, Distribution as Competitive advantage, Rationalizing Local Channels, Wholesaling, Retailing, Global Logistics, Parallel Distribution, Global Channel Design

International retailing

International expansion of retailers – international retailing defined – retail format – variations in different markets – general merchandise: retailing – issues in international retailing

Module VI

(7 Hours)

Pricing decisions: Global Pricing Framework, Pricing Basics, Marginal Cost Pricing and its importance, Transfer Pricing, Counter trade, Systems Pricing, Pricing and Positioning, price quotation – INCO terms – preparation of quotations.

Promotion Decisions

Promotions – international advertising – sales promotion in international markets – international advertising – direct mailing – personal selling – exhibition – generic promotions in international marketing

Module VII (6 Hours)

Recent trends in India's foreign trade: Institutional infrastructure for exports promotions in India – India's trade policy – exports assistance – exports documentation and procedures including different stages of documentation

Globalization in India, Opportunities, Constraints and Initiatives

India - A Hub for Globalization, Globalization in India - Post Liberalization, India's Strengths, Strategies for Sustainable Competitive Advantage, Potential for Made in India, Major Globalization Initiatives from Indian Companies, WTO Regulations and their implications for India, Undesirable effects of globalization, Government Initiatives needed to foster globalization

Module VIII (2 Hours)

The future of global marketing: Six major changes in global marketing

Case studies (5 Hours)

Practical Components:

- Go to the web sites of companies like Coca Cola, Toyota, Nike etc: study their practices in India as well as their home country in the areas of technology, pricing, service, warranty, advertising etc.
- A toy manufacturer in Channapatna wants to export his toys to Bangladesh and USA. Based on internet research, what would you advise them regarding the 4 P's of marketing? If he is willing to change his designs too, what would you recommend?
- Study the progress of foreign MNC's who entered India alone (Yamaha, Ford, Hyundai etc) and those who went for a Indian partner (Toyota, Honda, Suzuki etc) and study their progress. Did it make any difference to have an Indian partner?
- Students can visit international franchises operating in India like Mc Donald, KFC, Pizza hut and so forth to get an insight about modes of internalisations covering challenges and prospectus for franchising.

RECOMMENDED BOOKS:

1. International Marketing – Cateora, Graham, 15/e, TMH, 2012.
2. International Marketing – Varshney, Bhattacharya – S Chand
3. Global Marketing Management – Warren J. Keegan, 7/e, Pearson.
4. Global Marketing - Johny K. Johannson, 4/e, TMH.
5. International Marketing – Dana, Nicoleta, Lascu, Biztantra, 2003
6. International Marketing – Francis Cherunillam, 7/e, HPH, 2004.
7. Global Marketing Strategies – Jean, Pierre Jeannet, 6/e, Biztantra.
8. International Marketing -Naragundkar R, Excel Books.

REFERENCE BOOKS:

1. International Marketing: Analysis And Strategy - Sak Onkvisit, Johnshaw , 4/e Biztantra.
2. International Marketing – Rakesh Mohan Joshi, Oxford, 2004.
3. International Marketing – Michael Czinkota, Illka A. Ronkainen, Cenage Learning.
4. International Marketing – Srinivasan R, 2/e, PHI.
5. International Logistics – Pierre David, Biztantra, 2005.
6. International Management: A Strategic prespective, John B Cullen & K Praveen Parboteeah, 1/e, Thomson.

SEMESTER IV: FINANCE AREA**PROJECT APPRAISAL, PLANNING & CONTROL**

Sub Code: 12MBAFM425	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I**(4 Hours)**

Planning & Analysis Overview: Phases of capital budgeting – Levels of decision making – objective.

Resource Allocation Framework: Key criteria for allocation of resource – elementary investment strategies – portfolio planning tools – strategic position and action evaluation – aspects relating to conglomerate diversification – interface between strategic planning and capital budgeting.

Module II**(6 Hours)**

Generation and screening of project ideas: Generation of ideas – monitoring the environment – regulatory framework for projects – corporate appraisal – preliminary screening – project rating index – sources of positive NPV – qualities of a successful entrepreneur – the porter model for estimation of profit potential of industries.

Market and demand analysis: Situational analysis and specification of objectives – collection of secondary information – conduct of market survey – characterization of the market – demand forecasting – market planning.

Technical analysis: Study of material inputs and utilities – manufacturing process and technology – product mixes – plant capacity – location and site – machinery and equipment – structures and civil works – project charts and layouts – work schedule

Module III**(12 Hours)**

Financial Analysis: Estimation of cost of project and means of financing – estimates of sales and production – cost of production – working capital requirement and its financing – estimates of working results – breakeven points – projected cash flow statement – projected balance sheet.

Project cash flows: Basic principles of measurement of cash flows – components of the cash flow streams – viewing a project from different points of view – definition of cash flows by financial institutions and planning commission – biases in cash flow estimation.

Appraisal criteria: Net Present Value – benefit cost ratio – internal rate of returns urgency – payback period – accounting rate of returns – investment appraisal in practice.

Module IV**(10 Hours)**

Types and measure of risk – simple estimation of risk – sensitivity analysis – scenario analysis – montecarlo simulation – decision tree analysis – selection of project – risk analysis in practice.

Special decision situations: Choice between mutually exclusive projects of unequal life – optimal timing decision – determination of economic life – inter-relationships between investment and financing aspects – inflation and capital budgeting.

Analysis of firm and market risk: Portfolio theory and capital budgeting – capital asset pricing model – estimation of key factors – CAPM and Capital budgeting

Module V (5 Hours)

Social Cost Benefit Analysis(SCBA): Rationale for SCBA – UNIDO approach to SCBA – Little and Mirle approach to SCBA.

Module VI (4 Hours)

Multiple projects and constraints: Constraints – methods of ranking – mathematical programming approach – linear programming model –

Qualitative Analysis: Qualitative factors in capital budgeting – strategic aspects – strategic planning and financial analysis – informational asymmetry and capital budgeting – organizational considerations.

Environmental appraisal of projects: types and dimensions of a project – meaning and scope of environment – Environment – Environmental resources values – environmental impact assessment and environmental impact statement.

Module VII (5 Hours)

Project financing in India: Means of finance – norms and policies of financial institutions – SEBI guidelines – Sample financing plans – structure of financial institutions in India – schemes of assistance – term loans procedures – project appraisal by financial institutions.

Module VIII (10 Hours)

Project Management: Forms of project organization – project planning – project control – human aspects of project management – prerequisites for successful project implementation.

Network techniques for project management – development of project network – time estimation – determination of critical path – scheduling when resources are limit – PERT and CPM models – Network cost system (Only problems on resources allocation and resources leveling)

Project review and administrative aspects: Initial review – performance evaluation – abandonment analysis – administrative aspects of capital budgeting – evaluating the capital budgeting system of an organization.

Practical Component:

- Students can be asked to identify how the approaches to project appraisal differ between commercial projects in the private sector and a public sector.
- Students can visit a bank/financial institution and study the project appraisal criteria adopted by them
- Students can visit the organizations which have undertaken large projects (For eg: Bangalore Metro Rail Project) and study the risk associated with such projects and also study how they assess and manage such risks.
- Students can study the project financing provided by banks in India.

RECOMMENDED BOOKS:

1. Project Planning: Analysis, Selection, Implementation and Review – Prasanna Chandra, 7/e, TMH, 2011.
2. Project Management and Control – Narendra Singh, HPH, 2003.

REFERENCE BOOKS:

1. Project Management – Bhavesh M. Patel, 2/e, Vikas.
2. Project Management for Business and Technology: Principles and Practice – Nicholas, John M., 2/e, Pearson.
3. Project Management: The Managerial Process – Gray & Larson, 4/e, TMH, 2011.
4. Project Management: Small Steps Towards a Big Journey – Vasant Desai, HPH, 2009.

5. Construction Project Management, Planning, Scheduling and Control – Chitkara, 1/e, TMH.
6. Project Management – Choudhury, 1/e, TMH.
7. Project Management – K Nagarajan, New Age International, 2004.
8. Project Management – Merdith & Gopalan, Wiley India (P) Ltd. 2011.

Website:

<http://www.fundula.com/allcourses>

INTERNATIONAL FINANCIAL MANAGEMENT

Sub Code: 12MBAFM426/ 12MBABI436	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6Hours)

International financial Environment- The Importance, rewards & risk of international finance- Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution

Module II (8Hours)

International flow of funds and International Monetary system:-

International Flow of Funds: Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade and capital flows, Agencies that facilitate International flows. BOP, Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility.(problems on BOP)

International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).

Module III (6Hours)

Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Nominal , Real and Effective exchange rates, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behavior-Cross Rates- - Arbitrage profit in foreign exchange markets, Swift Mechanism. Triangular and locational arbitrage.

Module IV (6Hours)
International Financial Markets and Instruments :- Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, Cross listing of shares Global registered shares. International Financial Instruments: Foreign Bonds & Eurobonds , Global Bonds. Floating rate Notes, Zero coupon Bonds International Money Markets
International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements

Module V (8 Hours)
International Parity Relationships & Forecasting Foreign Exchange rate:- Measuring exchange rate movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effects. Covered Interest Arbitrage

Module VI (8Hours)
Foreign Exchange exposure:- Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure- Management of political Exposure- Management of Interest rate exposure.

Module VII (8Hours)
Foreign exchange risk Management: Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Currency Swaps-Interest Rate Swap- problems on both two way and three way swaps. Cross currency Swaps-Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country risk analysis.

Module VIII (6Hours)
International Capital Budgeting: Concept, Evaluation of a project, Factors affecting, Risk Evaluation, Impact on Value, Adjusted Present Value Method

Practical Component:

- Students can study the Balance of Payment statistics of India for the last five year and present the same in the class.
- Students can carry out a survey of Exporters and report the foreign exchange risk management practices adopted by them.

- Students can study the impact of exchange rate movement on the stock Index.
- Students can predicting exchange rates using technical analysis and find arbitrage opportunities using newspaper quotes present the same in the class.
- Students can visit a bank and study the foreign exchange derivatives offered by them.

RECOMMENDED BOOKS:

1. International Finance Management - Eun & Resnick, 4/e, Tata McGraw Hill.
2. Multinational Business Finance – Eiteman, Moffett and Stonehill, 12/e, Pearson, 2011.
3. International Corporate Finance - Jeff Madura, Cengage Learning, 10/e 2012.
4. International Financial Management – Vyuphakesh Sharan, 5/e, PHI, 2011.
5. Multinational Financial Management – Alan C. Shapiro, 8/e, Wiley India Pvt. Ltd., 2011.
6. International Financial Management – Madhu Vij, Excel Books, 2010.

REFERENCE BOOKS:

1. International Financial Management – Siddaiah T, 1/e, Pearson, 2011.
2. International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
3. International Finance – Shailaja G, 2/e, University Press, 2011.
4. International Financial Management – Apte P. G, 6/e, TMH, 2011.
5. International Finance – Maurice Levi, 5/e, Routledge, 2009.
6. International Financial Management – Jain, Peyrard & Yadav, Macmillan 2010
7. International Finance – Thomas O'Brien, Oxford University Press, 2010.

RISK MANAGEMENT

Sub Code: 12MBAFM427	IA Marks	: 50
No.of Lecture Hrs/week : 04	Exam Hrs.	: 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks	: 100
Practical Component : 01 Hr/ Week		

Module I (4 Hours)

Over view of Risk, Risk identification, Risk, Insurance and Management: Introduction to Risk and Insurance. Risk identification and Risk Evaluation,

Risk assessment & Management- Risk analysis: Exposure of physical assets, financial assets, and Human assets, Exposure to legal liability. Risk Management, Risk control.

Module II (7 Hours)

Risk Management using futures and forwards differences-valuation of futures, valuation of long and short forward contract. Mechanics of buying & selling futures, Margins, Hedging using futures -specification of futures -Commodity futures, Index futures interest rate futures-arbitrage opportunities.

Module III (8 Hours)

Risk Management using Swaps: Mechanics of interest rate swaps – volatility of interest rate swaps –currency swaps –valuation of currency swaps.

Module IV (10 Hours)

Risk Management using Options: Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity-mechanics of options- stock options- options on stock index- options on futures – interest rate options. Concept of exocotic option. Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes analysis, option Greeks. Arbitrage profits in options.

Module V (7 Hours)

Commodity derivatives: commodity futures market-exchanges for commodity futures in India, Forward markets, commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities.

Module VI (7 Hours)
Interest rate markets-Type of rates, Zero rates, Bond pricing, Determining Zero rates, Forward rates, Forward rate agreements (FRA), Treasury bond & Treasury note futures, Interest rate derivatives (Black model).

Module VII (5 Hours)
Credit risk-Bond prices and the probability of default, Historical default experience, Reducing exposure to Credit risk, Credit default swaps, Total return swaps, Credit spread options, Collateralized debt obligation.

Module VIII (8 Hours)
Value at Risk (VAR)-Measure, Historical simulation, Model building approach, linear approach, Quadratic model, Monte Carlo simulation, stress testing and back testing

Practical Components:

- Students can visit a financial institution dealing in commodity derivatives and study the products offered by him.
- Students should individually select various futures or options and watch the behavior of these futures and options on a day to day for 15 days to see how futures and options might help mitigate the risks of investors.

RECOMMENDED BOOKS:

1. Options Futures & Other Derivatives - John C. Hull, 6/e, Pearson Education.
2. Options & Futures- Vohra & Bagri, 2/e, TMH
3. Derivatives- Valuation & Risk Management - Dubofsky & Miller, Oxford University Press, 2005.
4. Financial Derivatives – Mishra V, Excel Books.
5. Derivative and Risk management, Sundaram Janakiram, Pearson, 2011.

REFERENCE BOOKS:

1. Risk Management & Insurance – Harrington & Niehaus, 2/e, TMH.
2. Risk Management & Derivative – Shulz, Cengage Learning.
3. Principles of Risk Management & Insurance – George E. Rejda, 11/e, Pearson Education, 2011.
4. Introduction to Derivatives and Risk Management – Don M. Chance, Cengage Learning, 2008.

5. Introduction to Risk Management & Insurance – Mark S. Dorfman, 9/e, Pearson, 2008
6. International Risk & Insurance –Skipper, TMH
7. Options & Futures –Edwards & Ma, 1/e, MacGraw Hill.
8. Derivatives & Financial Innovations – Bansal, TMH.
9. Credit Risk Management – Anderw Fight , 1/e, Elsevier.
10. Financial Derivatives –Kumar S. S. S, PHI, 2007.
11. Risk Management – Koteswar, HPH.
12. Futures, Options and Swaps – Robert W. Kolb, 5/e, Wiley India Pvt Ltd. 2011.
13. Risk Management and Insurance, Treishumann, James S., 12/e, Cengage Learning.
14. Risk Accounting & Risk Management for Accountants – Chorafas D, 1/e, Elsevier.

TAX MANAGEMENT

Sub Code: 12MBAFM428	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	
Ratio of Theory to problems = 40:60	

Module I **(7 Hours)**

Basic concepts: assessment year, previous year, person, assessee, Income, charges on income, gross total income, capital and revenue receipts, residential status, receipt and accrual of income, connotation of income deemed to accrue or arise in India. Tax Planning, Tax Evasion and Tax Management. (Problems on residential Status of Individual assessee)

Module II **(8 Hours)**

Explanation under various heads of income. Income from salary (Theory and full fledged Problems) Income from House Property (Theory Only)

Module III **(10 Hours)**

Income under the head profit and gains of business or professions and its computation- basis- method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation (Problems)

on computation of income from business/ profession of Individual assessee and Depreciation).

Module IV (8 Hours)

Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain (theory & problems), deductions from capital gains.

Module V (6 Hours)

Income from Other Sources (Theory Only) Permissible deductions under section 80C to 80U. Setoff and carry forward of losses and clubbing of Incomes.

Module VI (6 Hours)

Computation of tax liability of a firm and partners.

Module VII (6 Hours)

Computation of taxable income of a company with special reference to MAT. Corporate dividend Tax.

Module VIII (5 Hours)

Central excise act- objects and provisions of the act in brief (theory)- goods, excisable, CENVAT- **Customs act** - Basic definition, charge. **Central sales tax and VAT** (Only basic Concept).

Practical Components:

- Understanding the usage of software package while calculating different taxes
- Preparation of Income tax returns of Individual assesses.
- Preparation of sales tax returns
- Studying the online submission of Income tax returns

RECOMMENDED BOOKS:

1. Direct Taxes – Vinod Singhania and Kapil Singhania, Taxman Publications
2. Indirect Taxes – V S Datey, Taxman Publications.

REFERENCE BOOKS:

1. Students Guide to Income Tax – Vinod Singhania, Taxman Publications.
2. Direct Tax – Mehrotra, Sahitya Bhavan
3. Students Guide to Income Tax – Manoharan T. N, Snow White.

4. How to deal with VAT- Kul Bushan, 1/e, Pearson Education/PHI, 2004.
5. Income Tax Law & Practice - Mahesh Chandra & Shukla, Pragathi Publications
6. VAT – Pillai, Jaico Publications, 2004
7. Direct Tax – Lal & Vashisht, Pearson Education
8. Direct Taxation – Meena Goyal, Biztantra publication,

SEMESTER IV: BANKING AND INSURANCE AREA

TREASURY AND RISK MANAGEMENT

Sub Code: 12MBABI435	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (4 Hours)
Introduction to treasury management – Objectives – Concept – Functions of integrated treasury – Process of Globalization – Evolving role of Treasury as profit centre - Organization of treasury

Module II (6 Hours)

Treasury products – Short term funds and investment management – Financial marketing – Money market – Capital market – Call money – Government securities – REPOs – Repo Rate – Repo Pricing –Types of Repos -Certificate of deposits – Rediscounting bills - Commercial papers – Inter- Bank Participation Certificate –Collaterised Borrowing and Lending Obligations (CBLO) -Foreign Exchange Markets & treasury – Linkage of domestic operations with foreign operations.

Module III (8 Hours)
Asset Liability Management – I: Risk Management Process – Risk Organization – Asset Liability Management (ALM) – Objectives – Organization – Functions of ALCO – Risks – Interest Rate Risk – Liquidity Risk – Assessment of Liquidity – Maturity Profile & Interest Rate Ladder Credit Risk – Currency Risk – Capital Risk – Contingent Risk – BASEL Norms I, II and III

Module IV (8 Hours)
Asset Liability Management – II: Interest rate risk and management (IRRM) Interest rate risk – GAP analysis –Rate sensitive Gap Report - Duration & Immunization – Managing IRRM with Derivatives - Simulation technique. – Asset Securitization

Module V (6 Hours)
Asset Liability Management – III: Risk Exposure analysis – Stress Testing – Exposure Document - Open position – Stop-loss Limit - – Modified Duration – Convexity - Risk Adjusted Return on Capital (RAROC) – Audit Risk Management

Module VI (12 Hours)
Financial futures – Forwards - FRA and interest rate swaps – Cross currency swaps – Options – Caps - Floors and Complex swaps for managing interest rate risk – Foreign Exchange risk management using derivatives.

Module VII (6 Hours)
Sound practices for management and supervision of operational risk (SPOR)
– Three approaches to SPOR
Operational risks – Identification – Effects and Causes – Assessment – Measurement – Scenario Analysis
Market Risk – Types - Market Risk Identification – Model Risk – Risk Identification in practice

Module VIII (6 Hours)
Risk Measurement – Nominal Amount Approach – Sensitivity Based Approach – Basis Point Value –Value at Risk (VaR) – Computation of VaR –VaR and Absolute VaR – Usefulness and Limitations of VaR - Back Testing – Stress Testing

Practical Components:

- Students can visit a treasury department of a bank and study the treasury management activities and submit a report.
- Students can study the risk management criteria adopted by banks relating to Asset backed and non asset backed (Housingloan/Personal loan)

RECOMMENDED BOOKS:

1. Risk Management – IIBF, Macmillan, New Delhi, 2011.
2. Financial Risk Management – Vivek & Asthana, Himalaya Publishers, 2011.
3. Theory & Practice of Treasury & Risk management in Banks - IIBF, Taxmann Publications (P) Ltd (For Problems on Module 6 Refer chapter 7 to 10).
4. Managing Life Insurance – Shashidharan K Kutty, PHI Learning.

REFERENCE BOOKS:

1. Treasury Management – IIBF, Macmillan, New Delhi, 2011.
2. Risk management: Insurance & Derivatives- Kotreshwar G, 2/e, Himalaya Publishing House, 2012.
3. Commercial Banking - Benton Gup & James Kolari, 3/e, Wiley India Pvt. Ltd., 2010.
4. Introduction to Derivatives & Risk Management – Chance, Cengage Learning, New Delhi.

INTERNATIONAL FINANCIAL MANAGEMENT

Sub Code: 12MBABI436/ 12MBAFM426	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I**(4Hours)**

International financial Environment- The Importance, rewards & risk of international finance- Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution

Module II**(8Hours)****International flow of funds and International Monetary system:-**

International Flow of Funds: Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade and capital flows, Agencies that facilitate International flows. BOP,

Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility.(problems on BOP)

International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).

Module III (7Hours)

Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Nominal , Real and Effective exchange rates, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behavior-Cross Rates- - Arbitrage profit in foreign exchange markets, Swift Mechanism. Triangular and locational arbitrage.

Module IV (7Hours)

International Financial Markets and Instruments :- Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, Cross listing of shares Global registered shares. International Financial Instruments: Foreign Bonds & Eurobonds , Global Bonds. Floating rate Notes, Zero coupon Bonds International Money Markets International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements

Module V (8 Hours)

International Parity Relationships & Forecasting Foreign Exchange rate:- Measuring exchange rate movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effects. Covered Interest Arbitrage

Module VI (8Hours)

Foreign Exchange exposure:- Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure- Management of political Exposure- Management of Interest rate exposure.

Module VII (8Hours)
Foreign exchange risk Management: Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Currency Swaps-Interest Rate Swap- problems on both two way and three way swaps. Cross currency Swaps-Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country risk analysis.

Module VIII (6Hours)
International Capital Budgeting: Concept, Evaluation of a project, Factors affecting, Risk Evaluation, Impact on Value, Adjusted Present Value Method

Practical Component:

- Students can study the Balance of Payment statistics of India for the last five year and present the same in the class.
- Students can carry out a survey of Exporters and report the foreign exchange risk management practices adopted by them.
- Students can study the impact of exchange rate movement on the stock Index.
- Students can predicting exchange rates using technical analysis and find arbitrage opportunities using newspaper quotes present the same in the class.
- Students can visit a bank and study the foreign exchange derivatives offered by them.

RECOMMENDED BOOKS:

1. International Finance Management - Eun & Resnick, 4/e, Tata McGraw Hill.
2. Multinational Business Finance – Eiteman, Moffett and Stonehill, 12/e, Pearson, 2011.
3. International Corporate Finance - Jeff Madura, Cengage Learning, 10/e 2012.
4. International Financial Management – Vyuphakesh Sharan, 5/e, PHI, 2011.
5. Multinational Financial Management – Alan C. Shapiro, 8/e, Wiley India Pvt. Ltd., 2011.
6. International Financial Management – Madhu Vij, Excel Books, 2010.

REFERENCE BOOKS:

1. International Financial Management – Siddaiah T, 1/e, Pearson, 2011.
2. International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
3. International Finance – Shailaja G, 2/e, University Press, 2011.
4. International Financial Management – Apte P. G, 6/e, TMH, 2011.
5. International Finance – Maurice Levi, 5/e, Routledge, 2009.
6. International Financial Management – Jain, Peyrard & Yadav, Macmillan 2010
7. International Finance – Thomas O'Brien, Oxford University Press, 2010.

LEGAL ASPECTS OF BANKING & INSURANCE

Sub Code: 12MBABI437	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (9 Hours)
Legal framework of regulation of banks – Control over organization of banks – Regulation of banking business- Returns- Inspection and winding up – Banking Regulation Act,1949 - RBI Act, 1934.

Module II (9 Hours)
Legal aspects of banking operations – Responsibility of paying banker- Collecting banker - Indemnities- Bank Guarantees- Letters of Credit – Bill Finance

Module III (7 Hours)
Law relating to securities and modes of charging – Types of borrowers – Types of credit facilities – Secured & unsecured loans – Registration and satisfaction of charges

Module IV (9 Hours)
SARFAESI Act, 2002: Introduction – Securitization of financial assets – Enforcement of security interest – Banking Ombudsman Scheme, 2002- Procedure for redressal of grievances – Arbitration procedure- Conciliation

Module V (5 Hours)
Recovery of assets due to Banks and FIs Act,1993- Tribunal and appellate tribunals – Provisions and procedure of tribunals – Bankers Book Evidence Act 1891

Module VI (5 Hours)
Insurance Contract Analysis – Legal framework of Insurance Business - Claims Negotiation – Understanding contracts structure – Standard contract provisions of Life Insurance

Module VII (8 Hours)
Legal aspects of Insurance – Insurance Act 1938 – Indian contract Act 1872 – Consumer Protection Act, 1986 – Life insurance Act 1956 – Insurance Regulatory and Development Authority Act, 1999 –Re-Insurance and Double-Insurance - Motors Vehicles Act 1938 & 1988- Public Liability Insurance Act,1991

Module VIII (4Hours)
Insurance Documents – Insurance forms –Proposal forms – Cover Notes – Certificate of Insurance – Policy Forms – Endorsements – Other Documents

Practical Components:

- Students can study the regulatory framework of insurance under IRDA act and present the same in the class.
- Students can study the regulatory framework of Banks under Banking Regulations act 1949.

RECOMMENDED BOOKS:

1. Legal and Regulatory Aspects of Banking Operations – IIBF, 2/e, Macmillan, New Delhi.
2. Insurance & Risk management – P K Gupta, 2/e, Himalaya Publishing House 2011.

REFERENCE BOOKS:

1. Banking Theory& Practice - Srivastava P. K. Himalaya publishing House, Mumbai.
2. Banking Theory Law and Practice – Natarajan K and Gorden E., HPH.

STRATEGIC CREDIT MANAGEMENT

Sub Code: 12MBABI438	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (8 Hours)
Credit management in banks-Screening of applications-Appraisal of credit-Sanction limit- Post sanction compliance – Monitoring supervision –Review-Government policies for credit extension- Credit institutions- Principles of good lending- Borrower study and bankers opinion- Credit policy by banks-Government regulation of credit -Prudential norms.

Module II (8 Hours)
Over view of credit policy and loan characteristics-The credit process – Characteristics of different types of loans- Evaluating commercial loan requests – Financial statement analysis-Cash flow analysis- Projections-Management of the firm and other factors –Feasibility study – Fundamental credit issues - Credit analysis-Different types of borrowers – Balance sheet analysis for lending – Forms of advances secured and unsecured advances-Short term and long term advances.

Module III (5 Hours)
Evaluating consumer loans – Types- Credit analysis of consumer loans-Risk–return analysis of consumer loans- Customer profitability analysis and loan pricing- Fixed Vs floating rates

Module IV (6 Hours)
Loan and advances against pledge- Hypothecation- Mortgage – Lien-Advances against goods- Document to title to goods – Life insurance policies – Stock exchange securities-Fixed deposit receipts –Book debts- Supply bills- Real estates – Advance against collateral securities

Module V (7 Hours)
Agricultural finances and Retail lending- Crop loans- Crop insurance schemes- Dairy- Sericulture- Poultry- Animal husbandry – Horticulture – Gobar gas – Kissan credit cards – NABARD initiatives – Lead bank schemes – Retail banking advances – Concept – Retail banking products – Consumer credit financing

Module VI (8 Hours)
Financing to small scale industries and large scale industries- Term lending- Syndicated loan system- Role of development banks in industrial finance- Working capital finances- Turnover method – Modified version of MPBF – Cash budget approach- Long term finance-Project financing – Industrial sickness and BIFR.

Module VII (5 Hours)
Import and export credit- ECGC- EXIM Bank – Venture capital financing –Documentation for credit extension – Charge creation – Law of limitation

Module VIII (9 Hours)
NPA management – Introduction- Identification of NPA"s- CC-OD-Term loans-Bills purchased-Other accounts-Asset classification- Prudential norms-Capital adequacy – International Banking Regulation-Basel II – asset classification provisioning – effect of NPA on profitability - Assessment procedure- Pre-sanction appraisal – Post sanction supervision- Monitoring systems for existing and likely NPA"s-Rehabilitation of sick NP units – Recovery of NPA"s- Compromise and negotiated settlements- Securitization of Debts-Credit derivatives - Credit portfolio management (concentration risks)

Practical Components:

- Students can visit a bank and study the lending process adopted relating to Agricultural loan, consumer financing.
- Students can visit a bank and study the loan appraisal system followed.
- Students can study the NPA status of leading five PSU banks and five private banks.

RECOMMENDED BOOKS:

1. Banking Theory and Practice - Shekar and Shekar, 19/e, Vikas Publishing House, 2009.
2. Bank Management - W. Koch Scott, Timothy, Cengage Learning, New Delhi.
3. Commercial Banking -Benton Gup & James Kolari, 3/e, Wiley India, 2010.

REFERENCE BOOKS:

1. Industrial Finance - Vishwanathan R, Macmillan, New Delhi.
2. Banking and Financial System - Prasad K, Nirmala and Chandradas. Himalaya Publishing House, Mumbai.
3. Managing Banking Risks - Cade, Eddic, Woodhead Publishers, England.

SEMESTER IV: HUMAN RESOURCES AREA

INTERNATIONAL HUMAN RESOURCE MANAGEMENT

Sub Code: 12MBAHR445	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (8 Hours)
Introduction to IHRM Definition, reasons for going global, Approaches to IHRM, Difference between IHRM and Domestic HRM, Reasons for emergence of IHRM, Models of IHRM-Matching model, Harvard Model, Contextual Model, 5P Model European Model, Models of SHRM in Multinational Companies, Internationalization of HRM: Socio-cultural context, Organizational dynamics and IHRM: Role of culture in International HRM, Culture and employee management issues, Organizational Processes in IHRM, Linking HR to International expansion strategies, The Challenges of International Human Resource Management.

Module II (6 Hours)
Strategies for International Growth: Exploiting global integration-The logic of global integration, differentiation, Mastering expatriation, beyond the traditional expatriate model, the limits of global integration. Becoming locally responsive: The roots of responsiveness, understanding diversity, responding to diversity, the challenges of localization. Managing alliances and joint ventures- meaning, need, different kinds of alliances, planning and negotiating alliances, implementing alliances, supporting alliance learning, the evolving role of alliances.

Module III (8 Hours)
Recruitment, Selection and staffing in International context: International Managers- parent country nationals, third country nationals, host country nationals, advantages and disadvantages of different selection methods, different approaches to multinational staffing decisions, recruitment methods- using head-hunters, cross-national advertising, e-recruitment; Selection criteria and techniques, use of selection tests, interviews for international selection, international staffing issues.

Module IV (6 Hours)
Performance Management: A conceptual background, Constraints in goal attainment, performance management cycle, models, performance and appraisal in IHRM appraisal of expatriate, third and host country employees, issues and challenges in international performance management, country-specific performance management practices.

Module V (7 Hours)
Training and development in international context: Context Backdrop of international training, Current scenario in international training and development, training & development of international staff, types of expatriate training, HCN training, Career Development, repatriate training, developing international staff and multinational teams, knowledge transfer in multinational companies.

Module VI (8 Hours)
International Compensation: Forms of compensation and factors that influence compensation policy, key components of international compensation, Approaches to international compensation, compensation practices across the countries, social security systems across the countries, global compensation: emerging issues.

Module VII (5 Hours)
International Labour Relations: Key issues, response of labour unions to MNCs. HRM practices in different countries- Japan, USA, UK, Turkey, Middle East, India and China.

Module VIII (8 Hours)
HRM practices in different countries- Japan, USA, UK, Turkey, Middle East, India and China.

Practical components:

- Write an essay on the challenges faced by Indian multinational companies in deploying employees from one country to another.
- Give a MNC recruitment case and ask the students to design and present a recruitment strategy.
- Debate on the challenges involved in measuring performance of employees in multinational context.

- Give a case and role play it, to negotiate the compensation of a software engineer to be posted from Bangalore to Seattle.
- Debate the Visa policy of India for hiring foreign workers.

RECOMMENDED BOOKS

1. International Human Resource Management - Monir H. Tayeb, Oxford University Press, 2005.
2. International Human Resource Management - Peter J. Dowling, Denice E. Welch, Cengage Learning

REFERENCE BOOKS:

1. International Human Resource Management - Aswathappa K, Sadhna Das, Mc Graw Hill.
2. The Global Challenge : ramework for international human resource management - Evans, Pucik, Barsoux, Tata McGraw-Hill Irwin.
3. International Human Resource Management - Tony Edwards, Chris Rees, Person Education.
4. International Human resource Management – Rao P. L, Excel Books.
5. International Human resource Management – Chris Brewster, University Press.

PERSONAL GROWTH AND INTERPERSONAL EFFECTIVENESS

Sub Code: 12MBAHR446	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(5 Hours)

Personal growth: Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organizational roles, role clarity and role boundaries. Ego states- Id, ego and super ego and defense mechanism. Developing a self improvement plan.

Module II (6 Hours)
Interpersonal Trust: Openness, confidentiality, blind spot and unknown part of personality. Self disclosure, seeking feedback, self reflection and practicing new behaviors. Discovering facets of interpersonal trust through Johari Window.

Module III (8 Hours)
Understanding human personality: Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B, Emotional intelligence.

Module IV (8 Hours)
Attitudes, beliefs, Values and their impact on behavior: Personal change-meaning, nature and requisites. Social adjustments and habit formation. Locus of control. Habits of personal effectiveness. Seven habits of highly effective people.

Module V (8 Hours)
Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming.

Module VI (6 Hours)
Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, time management and honoring the commitments,

Module VII (7 Hours)
Transactional Analysis: Ego states, types of transactions and time structuring. Life position, scripts and games.

Module VIII (8 Hours)
Experiential learning methodologies-T-group sensitivity training, encounter groups, appreciative enquiry and group relations conference (students may go through three days personal growth lab for experiential learning)

Practical components:

- Students are expected to conduct an in depth study about various personality traits & TA and submit a detailed report.

- Students have to undergo psychometric test like MBTI, FIRO-B, Big Five etc , conduct SWOT analysis and prepare a personal growth plan based on the results
- Ask the individual students to seek multisource feedback about their interpersonal effectiveness from peers, teachers, and parents; understand and reflect the feedback and prepare a development plan for interpersonal effectiveness.
- Discuss a Johari Window case in the class to identify how it can help each individual student to promote his/ her personal growth.
- Organize a workshop on MBTI for the students to know their type and to understand the type dynamics.
- Organize a neuro linguistic programming workshop for the participation of all HR students.

RECOMMENDED BOOKS:

1. Organizational Behaviour: Human Behavior at work – John W. Newstrom and Keith Davis, 11/e, Tata McGraw Hill, 2003.
2. Human Relations in organizations - Robert N. Lussier, 6/e, McGraw Hill Education.
3. Development of Management Skills - Whetten & Cameron, 7/e, PHI.
4. Competency Mapping Assessment and Growth - Naik G. P, IIHRM, 2010.

REFERENCE BOOKS:

1. Understanding OB - Udai Pareek, Oxford University Press.
2. Theories of Personality- Calvin S Hall, 4/e, Wiley India Pvt. Ltd.
3. Seven habits of highly effective people - Stephen R Covey, Pocket Books.
4. Training in interpersonal Skills- Stephen Robbins, Pearson Education.

Website:

<http://www.fundula.com/allcourses>

ORGANIZATION DEVELOPMENT AND CHANGE

Sub Code: 12MBAHR447	IA Marks	: 50
No.of Lecture Hrs/week : 04	Exam Hrs.	: 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks	: 100
Practical Component : 01 Hr/ Week		

Module I (6 Hours)
Introduction to organizational Development: Definition, growth and relevance, history and evolution. Theories of planned change, general model of planned change, different types of planned change and critique of planned change. OD practitioner role, competencies and professional ethics.

Module II (6 Hours)
OD process: Initiating OD relationship, contracting and diagnosing the problem. Diagnosing models, open systems, individual level group level and organizational level diagnosis; collection and analysis for diagnostic information, feeding back the diagnosed information.

Module III (9 Hours)
Designing OD interventions: Human process interventions:- coaching, training and development, process consultation, third part intervention, and team building. Organization confrontation meeting, intergroup relations intervention, and large group intervention.
Techno structural interventions:- Structural design , downsizing, reengineering, employee involvement, work design, socio technical systems approach,

Module IV (9 Hours)
HR and Strategic interventions : HRM interventions:- performance management, goal setting, performance coaching, appraising and rewarding. Career planning, workforce diversity interventions, wellness and work-life balance,
Strategic interventions: Competitive strategies, collaborative strategies, organizational transformation, culture change, self designing organizations, learning and knowledge management.

Module V (6 Hours)
Special applications of OD : OD in, health care organizations, family owned organizations, educational institutions, public sector organizations and future directions in OD.

Module VI (8 Hours)
Introduction to organizational change: Nature of change, forces of change, reinventing Kurt Levin, organizational routines and mental models, change need analysis, content of change, types and styles of change, building capability for change, providing leadership to change, action research and dialogue, types of change, organizational vision, cultural change, strategic planning, creating support systems and managing transition, process oriented strategies and competitor oriented strategies and customer oriented strategies.

Module VII (6 Hours)
Appreciating change: External environment as drivers of change, business cycles, industry cycles, technology and strategic change, industry evolution and concentration, developing a change agenda. Cognition and organizational change, mental models, organizational learning, Senge's five disciplines, business models and value propositions, refining the change agenda

Module VIII (6 Hours)
Mobilizing support and executing change: Four approaches to change, parallel organization, ownership and involvement in change, dealing with political aspects of change, the psychology of persuasion, communicating to influence, targeting influence efforts, framing change, making difficult choices, negotiating change. Executing change: challenges of execution, execution framework, developing cross functional linkages, aligning policies, and removing structural impediments, developing new routines for innovation and improvement, considering human element.

Practical components:

- Students are expected to study the changes that have taken place in various industries over a period of ten years and submit a report.
- Hold a debate in the classroom about downsizing the workforce.
- Identify the need for OD intervention for your college and call the director/ principal of your college to the classroom to explore the possibility for OD intervention.
- Debate the phrase "change is the only constant thing" along with the field-force theory of Kurt Levin.
- Design a role play event for students, so that they will play it out to mobilize support for a change implementation programme.

RECOMMENDED BOOKS

1. Organizational Development and Change - Cummings T.G. and Worley C. G., Cengage Learning, 2005.
2. Managing organizational change - Harigopal K, Response Books, 2006.
3. Change management - Nilakant V. and Ramnarayan S. Response books 2006.
4. Managing organizational change - Palmer, Dunford and Akin, 2011.
5. Organizational Change and Development – Kavitha Singh, Excel Books,2010.

REFERENCE BOOKS:

1. Organizational development - Ramnarayan S and Rao T V, Sage Publicatin, 2011.
2. Organization Development - Wendell L. French, Cecil H. Bell, Veena, Jr, Pearson Education.
3. Change Management - Radha Sharma, Tata McGraw Hill, 2007.

STRATEGIC TALENT MANAGEMENT

Sub Code: 12MBAHR448	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)

Talent Management: Meaning and significance of talent management. Aligning HRM goals to business, attracting talent, retaining talent, becoming the best employer by employer branding activities, inculcating performance culture, right sizing the workforce, work life balance initiatives, providing HR leadership to business.

Module II (8 Hours)

Competency Mapping: Features of competency methods, historical development, definitions, approaches to mapping and case studies in competency mapping. Competency mapping procedures and steps- business strategies, performance criteria, criteria sampling, tools for data collection, data analysis, validating the competency models, short cut method, mapping

future jobs and single incumbent jobs, using competency profiles in HR decisions.

Module III (8 Hours)

Methods of data collection for mapping.-observation, repertory grid, critical incidence technique, expert panels, surveys, automated expert system, job task analysis, behavioural event interview. Developing competency models from raw data- data recording, analyzing the data, content analysis of verbal expression, validating the competency models.

Module IV (8 Hours)

Performance Management: Definition of performance Management, the performance management contribution, dangers of poorly implemented PM systems, aims and role of PM Systems, characteristics of an ideal PM systems, performance management process, performance management and strategic planning. Performance goal setting, performance coaching and support, performance monitoring, performance appraisal. Performance feedback.

Module V (7 Hours)

Performance management & employee development: Personal Development plans, 360 degree feed back as a developmental tool, performance management & reward systems: performance linked remuneration system, performance linked career planning & promotion policy.

Module VI (7 Hours)

Employee engagement- meaning and significance, constituents of engagement, conceptual framework of engagement, behaviors associated with engaged employees, engaged, not engaged, actively disengaged, parameters to measure employee engagement, Q 12 model of Gallup, employee satisfaction survey .

Module VII (6 Hours)

Succession planning: Identifying managerial positions which are critical for the business. Identifying second line of leaders and developing their capabilities to occupy the critical positions in the event of the exit of current incumbents. Taking up lateral hiring when there is discontinuity in the succession plans.

Module VIII (6 Hours)

Career planning: Creating career growth opportunity. Mentoring employees for growth. Providing developmental job assignments, providing resources of

learning and development opportunities, vertical promotions and horizontal postings to promote career progression, psychological contract and career anchors.

Practical components:

- Students are expected to conduct a study on how talents are acquired and retained – in various industries – and various strategies followed by the respective companies.
- Students can be asked collect the information related to attrition rates in various sectors and identify the possible reasons for the same through a survey
- Ask the students to find out the best employer surveys conducted during the past one year and make a presentation.
- Ask the students to collect data about the position of principal, director, and other teachers in your college and prepare a competency dictionary for the said positions.
- Ask the students to role play the behavioural event interview to collect data for competency mapping for the position of management professor.
- Ask students to collect data in your college or any other organization using Q 12 instrument and analyze it to find out the engagement level of employees.
- Identify the important positions in your college or any other organization and ascertain the measures if any taken to develop second line of leadership. (2) Discuss a case relating to succession planning.

RECOMMENDED BOOKS:

1. Competence at work - Lyle M. Spencer, Signe M. Spencer. John Wiley 1993
2. Competency mapping, Assessment and Growth - Naik G.P, IHRM, 2010.
3. Performance Management - Herman Aguinis, Pearson Education, 2007.
4. The Talent Management Hand Book - Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill.
5. Appraising & Developing Managerial Performance- Rao T. V, Excel Books

REFERENCE BOOKS:

1. Performance Management - Dixit Varsha, 1/e, Vrinda Publications Ltd
2. A Handbook of Competency Mapping – Seema Sangi, Response Books, 2004
3. The Talent Management Hand Book - Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill.

SEMESTER IV: CREATIVE MANAGEMENT AREA**MODERN RETAIL AND PRIVATE BRANDS**

Sub Code: 12MBACM455	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I**(6 Hours)**

What is logistics and supply chain?, supply chain modeling, supply chain management, commercial and non-commercial parameters in supply chain, three key parts of supply chain – supply, Inventory control, Demand and Supply Planning, Logistics and transportation management, Warehouse management, Replenishment, Sourcing: In-house or Outsource, Factors affecting the cost and importance of logistics.

Module II**(6 Hours)**

Manufacturing, distribution; supply chain processes, supply chain operations, supply chain strategy, quality assurance, Designing the Supply Chain Network, Supply Chain Costs, Types of Supply Chains: Integrated Make-to-Stock Model, Build-To-Order Model, Continuous Replenishment Model, Channel Assembly Model, Procurement, International Supply Chain Management.

Module III**(8 Hours)**

Supply chain business process integration - CRM and CSM, demand management, product development and commercialization, etc., Indian v/s global trends in supply chain, supply chain in India – what can we do better? Building partnerships and trust, Continuous replenishment and vendor-managed inventories – planning, forecasting and replenishment.

Module IV (6 Hours)
Introduction to retail marketing, what is Experience Retail?, Retail v/s wholesale, Shift of powers in favour of retailers, What are basic principles of good retailing? Relationship marketing? Developing a retail strategy: What is the mission? What are the goals? Who are the customers? Retail shopping behavior of consumers: Demographics, lifestyle data, group and individual attributes

Module V (9 Hours)
Types of retailing – convenience store, CBD comparison store, street market, superstore, retail park metro stores, etc., Retail Location: Factors affecting retail location decision, Site selection, Factors affecting site selection, Steps in selecting site, Location based retail strategies, Store design - layout and space management, Visual merchandising and displays;

Module VI (9 Hours)
Retail pricing, second-hand retail, retail sales and management, retail management revolution, rural v/s urban retail, Indian v/s global trends in retail, Emergence of Organized Retailing, Traditional and Modern retail Formats in India, Retailing in rural India, FDI in Retailing

Module VII (6 Hours)
Retail marketing mix and planning, retail marketing strategy, Retailing as a brand-building medium, Advocacy in retail market, POP (point-of-purchase) & POC (point-of-consumption), Role of advertising, sales promotion, personal selling public relations and relationship marketing in retailing;

Module VIII (6 Hours)
Retail brands, private brands, Retailing in India, Key Features in Indian retail brand building, Future of retail branding – Indian scenario and global scenario. Customer behavior and Customer Relationship Management in retail environment, Display and Space Management, Impact of information technology in retailing, Electronic retailing - Role of web, online retailing

Practical Components:

- Spend a day during the week and the weekend at 3 different malls and record the profiles, numbers and behavior of the visitors.
- Map the points of purchase, points of consumption & branding opportunities at public transits e.g. railway stations, bus depots and airports.

- Select 5 categories and compare the brands vs. private labels across the entire marketing mix. Then interview their users and identify their motivations & reservations.
- Identify 5 successful brands which use retail as great customer relationship platforms and write a detailed project report & present to class & to the brand marketers
- Write an essay on 5 innovative retail experiences among global and Indian brands & Present to class.

RECOMMENDED BOOKS:

1. Narendra Agrawal, Stephen A. Smith, Hau L. Lee, Retail Supply Chain Management: Quantitative Models And Empirical Studies, Springer-verlag, 2008.
2. Dhandapani Alagiri, Kalai Selvan N, Retail Supply Chain Management: An Introduction, Icfai University Press, 2008.

REFERENCE BOOKS:

1. Ayers B. Ayers, James B. Ayers, Mary Ann Odegaard, Retail Supply Chain Management, Auerbach Publications, 2007.
2. John Fernie, Leigh Sparks, Logistics & Retail Management: Emerging Issues And New Challenges In The Retail Supply Chain, Kogan Page, 2009
3. John Dawson, John Dawson, Leigh Sparks, The Retailing Reader, Routledge, 2009
4. Leigh Sparks, Anna Findlay, Anne Findlay, Retailing: Critical Concepts (Four Volumes), Routledge. 2001
5. Michael H. Hugos, Chris Thomas, Supply Chain Management in The Retail Industry, John Wiley & Sons, 2005
6. Michael Hugos, Essentials of Supply Chain Management, John Wiley & Sons, 2006

FUTURE OF BRANDS AND BUSINESS

Sub Code: 12MBACM456	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I

(6 Hours)

What is a campaign & how best to plan the same; the various steps in an advertising campaigns; marrying immediate term & long term objectives

with each campaign tasks & budgets; what is indeed long term in today's tech-driven transient marketing world.

Module II (4 Hours)

Budgeting across channels & mapping these to their respective tasks; variations across demographic & psychographic segments; geographies; product categories; languages

Module III (8 Hours)

Role of project management in campaign planning & operations; coordination of creatives to publishers; performance reporting; communication & negotiations skills; non-verbal communication in negotiations; negotiations across cultures; team working & motivation skills; motivational techniques; team building within a project

Module IV (10 Hours)

What is the future of branding; Trends, Relationships in Consumer Markets, The Role of the Brand in Social Media Marketing; no-logo & private brands; emergence of mega retailing. Shifting power equations among brand owners & channel & consumers—indeed who owns the brands; the dynamic equilibrium among the different stake holders; the role of the internet in amplifying the power of the consumer

Module V (8 Hours)

Total branding solutions—an overview; implications for brand managers, creative professionals and media specialists; similarities & differences vs traditional processes & principles. Brand Icons, Overview on Iconic Branding, Brands and Icons, Regional Branding, Icons, What Makes an Iconic Brand?

Module VI (8 Hours)

New thinking in strategic branding & execution that marry both the streams of Total Branding Solutions and engagement planning. Co-creating brands with consumers; impact of search engines and internet on branding; customized branding; role of consumer empowerment in the personalization of brands.

Module VII (6 Hours)

Brand conversations & advocacy; use of direct marketing principles in brand conversations; brand mythology & p-o-vs. Challenges & opportunities when needs & wants are constantly changing & evolving.

Module VIII**(6 Hours)**

Brand awareness: Brand recall and Brand recognition; knowledge, preference, trial & loyalty compared to brand influence & advocacy; impact of new media & technology in accelerating this process; the importance of 'real-time'

Practical Components:

- Trace the evolution of brands & their offerings & innovations across 5 categories---FMCG, durables, services, corporate & government. Present your findings to a panel of marketers
- Write an essay on "What will happen if brands are banned one sudden day?" Review the books on no logo and similar genres and present to class.
- Review the literature on the impact of branding on other aspects of a company's performance e.g. stock market, talent recruitment etc and present to the class.
- Choose 5 domains that have benefited hugely by applying branding principles eg politics, cinema, music, social services and share your insights with the class through a detailed presentation
- Select 5 surprisingly successful brands and identify the secret of their success by interviewing their owners or consumers or channel. Make a presentation to the brand owners.

RECOMMENDED BOOKS:

1. Lovemarks: The Future Beyond Brands - Kevin Roberts, A. G. Lafley, Power house Books, 2005
2. Branding Unbound: The Future of Advertising, Sales, And The Brand Experience In The Wireless Age: Rick Mathieson, American Management Association, 2005.

REFERENCE BOOKS:

1. The 50 Plus Market : Why The Future Is Age Neutral When It Comes to Marketing & Branding Strategies - Dick Stroud, Kogan Page Limited, 2006.
2. Creating Passion Brands: How to Build Emotional Brand Connection With Customers - Helen Edwards, Derek Day, 2007
3. Creating Passion Brands: Getting To the Heart of Branding - Helen Edwards, Derek Day, Kogan Page, 2006
4. Managing Brand Equity - David Aaker, Free Press, 1991
5. Brand Relevance - David Aaker, Jossey-Bass, 2011
6. The Future Of Brands: Twenty-Five Visions - Rita Clifton, Esther Maughan, New York University Press, 2000.

LEADERSHIP AND ITS PRACTICE

Sub Code: 12MBACM457	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (4 Hours)
Concept of leadership; evolution of leadership over the years; myths about leadership; theories on leadership; Definitions of leadership, the necessity of leadership, Examples of leadership, The power of leaders and situations

Module II (8 Hours)
Components of leadership- leaders and followers; factors and principles of leadership; effect of leadership on organizational culture and climate; functions of leadership; leadership attributes; Theories of motivation, The extended leadership theory: Transformational, instrumental, transactional leadership

Module III (8 Hours)
Developing leadership skills-developing skills in problem solving, planning, delegation, internal communication, meeting management and managing yourself, Who is a Leader; Leadership Traits, Communication, Coaching and Conflict Skills, Leadership in Groups/Teams, Organizations, and the Public Sphere,

Module IV (8 Hours)
Application of leadership in different contexts; leadership at micro level and macro level; various styles of leadership; assessing leadership and measuring its effectiveness; Power & Influence, Importance of Leadership and its value to the organization, Difference and relationship between Leadership and management

Module V (4 Hours)
Leadership and change; situational leadership; planning in leadership; varieties of power, Types of Leaders and Styles of Leadership, The Leader's Character, Professional leadership competencies

Module VI (8 Hours)

Concept of individual leadership and group leadership; team building and building high performance teams; tools for leadership development among employees, Leader-Follower Relationship, Leaders and the Role of Personal Traits, Leadership and the Role of Gender, Leadership as an Influence Process,

Module VII (8 Hours)

Leadership and values; role of emotional quotient in leadership; ABC: authenticity, believability and consistency in leadership; accountability versus authority; leadership in non-profit organizations

Module VIII (8 Hours)

Case studies of well known leaders with different leadership styles; creativity and innovations in leadership; current trends and future of leadership practices, Leadership Problem Solving skills, Futuristic Planning in Leadership, Differences between supervision and leadership, Leadership and Productivity

Practical Components:

- Choose 3 successful & 3 failed leaders and identify the contributing factors and present your findings to the class.
- Across domains like sports & business & religion, develop an essay on the underlying trends and how these brands can leverage them.
- Write a comprehensive essay on management vs. leadership
- Interview 5 thought & practice leaders about their life learnings on leadership. Present your findings to a panel of these leaders.
- Choose 3 leaders who tasted success after failures and 3 who tasted failure after early successful and develop the lessons from both groups. Present your findings to a panel of these leaders.
- Do a thorough research about leadership & vulnerability & values & integrity.

RECOMMENDED BOOKS:

1. Leadership Theory To Practice: A Game Plan For Success As A Leader : Robert H. Palestini, Rowman & Littlefield Education, 2009
2. Authentic Leadership Theory And Practice: Origins, Effects And Leadership : Theory And Practice, Peter G Northouse, 5/e , Sage South Asia, Development - William L. Gardner, Bruce J. Avolio, Fred O. Walumbwa, Jai Press(ny), 2005.
3. Theory And Practice Of Leadership - Roger Gill, Sage Publications, 2006

4. Effective Leadership: Theory Meets Practice - Jerzy Straatmeijer, Vdm Verlag, 2009

REFERENCE BOOKS:

1. Leadership Development In Balance: Made/Born - Bruce J. Avolio, Lawrence Erlbaum Associates, 2005
2. Reordering The World: Geopolitical Perspectives On The 21st Century - George J. Demko, William B. Wood, 2/e, Westview Press, 1998.
3. Project Leadership: From Theory To Practice - Jeffrey K. Pinto, Peg Thoms, Todd S. Palmer, Project Management Institute, 1998

BRANDED CONTENT AND THE FUTURE OF MEDIA

Sub Code: 12MBACM458	IA Marks : 50
No.of Lecture Hrs/week : 04	Exam Hrs. : 03 Hours
Total No. of Lecture Hrs. : 56	Exam Marks : 100
Practical Component : 01 Hr/ Week	

Module I (6 Hours)
 Branded Content, Branded content and its importance, Traditional Marketing vs. Branded Content, Preparing a branded content brief: Vision, Target Audience, Objectives and Strategies, Elements, Production schedule, Performance Measurement Targets, Building blocks of engagement maps & attention apertures; immediacy & impact of different channels like newspaper vs. magazines vs. television vs. radio vs. internet etc.

Module II (8 Hours)
 What is a Brand? Can Everything Be Branded? Branding Challenges & Opportunities, Brand Equity: Meaning, Sources, Steps in Building Brands, The Brand Equity Concept, Strategic Brand Management Process, Establishing Brand Positioning, Positioning Guidelines, What is brand experience & its role in brand equity building; brand immersion vs. brand experience; traditional brand messaging vs. brand immersion.

Module III (6 Hours)
 Implications of the above principles across categories & channels & geographies & consumer segments; integrating technology in this, Brand Content Strategy, Building Resources and Your Branded Content Plan: Elements, Audience, Objectives, Developing a workable branded content marketing plan

Module IV (8 Hours)
Retail as a branding interface; the importance of points of purchase as well as points of consumption; can retail be an advocacy channel; the importance of salesmanship at retail across different product categories, Creating valuable branded content, Future of Branded Content and Branded Social Media

Module V (8 Hours)
Integrated media offering—opportunities & requirements; media monetization in the era of technology; implications of content creators. Technology & broad-band's impact on communication & branding

Module VI (4 Hours)
Challenges & opportunities in the interactive & mobile space; trends in brand conversations & advocacy, Mobile Marketing & Advertising , What is Interactivity? Confluence of interactivity, mobility, messaging, and media, Interactive Media vs. Other Kinds of Media

Module VII (6 Hours)
Different media sources & their differing credibility & influence across different communication tasks; media neutrality & source authority & expertise, Advantages and Limitations of various media.

Module VIII (10 Hours)
Globalizing of media appeals; what is loyalty in the interactive era; brand placement vs branded content; broad vs. narrow cast media. The changes in the business of media; challenges & how different media owners have responded, The impact of the Social Networking Media

Practical Components:

- Identify 5 successful properties across television, internet and magazines and research their insights and present to the class & to an external panel of media owners.
- Contemporary thinking indicates that companies should leverage their web site as their most important media and touch point with various stake holders. Identify three Indian & two global companies who are doing this well & present to the class.
- User generated content---its implications for editorial control---interview readers and editors and advertisers to develop this essay.
- Select five most innovative regional & local brands with their own branded content and do a detailed presentation to the class on their strategy. Present also to a panel of brand owners.

- Youtube---analyze the reasons for its stupendous success. Also identify 5 distinct brands that use youtube for their thematic & tactical campaigns.

RECOMMENDED BOOKS:

1. A New Brand Of Expertise: How Independent Consultants, Free Agents, And Interim Managers Are Transforming The World Of Work - Marion McGovern, Dennis Russell & Dennis Russell, Butterworth Heinemann Special Priced Titles, 2001.

REFERENCE BOOKS:

1. Marketing Manual: Focus On Branded Content, With Other Marketing Aspects - Bren Monteiro, 6 Degrees Books
2. Killer Web Content: Make The Sale, Deliver The Service, Build The Brand - Gerry McGovern, 1/e, A & C Black, 2006
3. Get Content Get Customers: Turn Prospects into Buyers with Content Marketing - Joe Pulizzi, McGraw-Hill, 2006
4. Guerrilla Advertising: Unconventional Brand Communication - Gavin Lucas and Michael Dorrian, Laurence King Publishers, 2006.

**The guidelines for 12 Weeks' Internship (Project Work)
(12MBA47) during 4th Semester MBA**

INTRODUCTION:

Internship (project work) is an integral part of the academic curriculum of VTU MBA. It is an initiative to bridge the gap between knowledge and its application through a series of interventions that will enable students of VTU MBA program to gain insights and exposure to the industry.

The 12 week Internship (project work) has been positioned during 4th semester of the MBA program as it serves the twin purposes of providing critical business insights to students as well providing industry with graduates of a high caliber who are ready to get ahead in the world from day one.

OBJECTIVES:

The objectives of conducting Internship (project work) during 4th semester of MBA program are:

- To provide an opportunity for students to apply theoretical concepts in real life situations at the work place;
- To sensitize students to the nuances of corporate culture and familiarize them with the corporate code of behavior;
- To enable students to manage resources, work under deadlines, identify and carry out specific goal oriented tasks;
- To enable students discover their professional strengths and weaknesses and align them with the changing business environment;
- To sharpen domain knowledge and provide cross functional skills

General Guidelines:

- A. Nature of Internship (project work):** The student will have to identify an Internship (project work) in a business enterprise that matches the student's area of specialization. Internship (project work) is a combination of In-plant study and a research project. Students are expected to study the functioning of an organization, identify a problem area and provide suggestions to overcome the problems.
- B. Duration of Internship (project work):** The Internship (project work) shall be for a period of 12 weeks immediately after completion of 6 theory papers during the first 12 weeks of the 4th semester but before the commencement of the University Examinations. Students are expected to take up the preliminary

work such as identifying the organization, finalization of topic and review of literature during the first 12 weeks of fourth semester and start the Internship (project work) immediately after this.

- C. Guide:** Internal guide of the Internship (project work) is a full time faculty member working in management department of respective institution with minimum of three years of experience. External guide is from the business organization where the student is carrying out his/her Internship (project work). Maximum of ten students can work under an internal guide. Internal guide is expected to be in continuous interaction with external guide during the course of the Internship.
- D.** No two students of an institute shall work on the same problem in the same organization.

E. Schedule to be followed before commencement of Internship

Activity	Time-line	Remarks
<ul style="list-style-type: none"> • Identifying the Organization • Problem Identification 	First two weeks of 4 th semester.	Student individually identifies an organization and identifies problem for his / her study, according to his / her interest
Problem Statement	3 rd week of 4 th semester.	His / her interests are discussed with selected guides
Research design	4 th week of 4 th semester.	Discussion with internal guide to decide on suitable design for the research
Synopsis preparation	5 th and 6 th week of 4 th semester.	Preparation of synopsis* incorporating the Objectives
Presentation of synopsis	7 th and 8 th week of 4 th semester.	The student will present Synopsis with the detailed execution-plan to the internship committee** who will review and may

		(a) approve, (b) approve with modification or (c) Reject for fresh synopsis.
Approval status	9 th and 10 th week of 4 th semester.	The approval status is submitted to HOD who will officially give concurrence for execution of the internship

***Synopsis: It is a 3 page document / hard copy to be submitted to the HOD with the signatures of Guide and the Student.**

Page 1	Title, contact addresses of student - with details of internal & External Guide
Page 2	Short Introduction with objectives and summary (300 words), Review of articles/literature about the topic with source of information.
Page 3	Time-Activity Chart

****Composition of the Internship committee**

1. Director/HOD
2. Domain expert from the department
3. Internal Guide

F. Schedule to be followed during Internship

Activity	Time-line	Remarks
Understanding structure, culture and functioning of the organisation.	First two weeks of internship.	Student should understand products/services and problems of the organization.
Preparation of research instrument for data collection	3 rd to 4 th week of internship.	Discussion with the guide for finalization of research instrument in his/her domain and present the same to the guide. (First presentation)

Data collection	5 th to 8 th week of internship	Data collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second presentation)
Analysis and finalisation of report	9 th to 11 th week of internship	Students must use appropriate and latest statistical tools and techniques for analyzing the data (It is must to use latest statistical packages whose results should be shown in the report) (Third presentation)
Submission of report	12 th week of internship	Final report should be submitted to the university before one week of the commencement of theory examination.

G. Evaluation:

- **Internal Evaluation:** Internal evaluation will be done by the internal guide.
- **External Evaluation:** External evaluation shall be done by a faculty member of other institute drawn from VTU institutions with minimum of 10 years' of experience.
- **Viva-voce / Presentation:** A viva-voce examination will be conducted at the respective institution where student is expected to give a presentation of his/her work. The viva-voce examination will be conducted by the respective HOD / Sr. Professor of the department and an expert drawn from VTU institutions with minimum of 10 years of experience as appointed by the University.

Internship (Project) work carries 300 marks consisting of 100 marks for internal evaluation by the internal guide, 100 marks for external evaluation and 100 marks for viva-voce examination

Format of the Internship report: The internship report shall be prepared using word processor Viz., MS word, using Times New Roman font sized 12, on a page layout of A4 size with 1" margin on

all sides and 1.5 line spacing. The internship report shall not exceed 75 pages.

- H. Submission of report:** Students should submit the internship report in electronic data form only, in PDF file (Un-editable format) to the Institute. Institute in turn shall submit all the CDs of their students along with a consolidated master list as per specialization containing USN, Name of the student, Title of the report to Registrar (Evaluation) one week before the commencement of the theory examinations.
- I. Publication of research findings:** Students are expected to present their research findings in seminars / conferences / technical fests or publish their research work in journals in association with their internal guide. Appropriate weightage should be given to this in the internal evaluation of the project report.

Contents of the Internship (Project) Report

- Cover page
- A certificate from the Organization (Scanned copy of the certificate)
- A certificate from the guide, HOD and Head of the Institution (Scanned copy of the certificate) indicating the bonafide performance of Internship by the student.
- Declaration (Scanned copy of the declaration) – An undertaking by the student to the effect that the work is independently carried out by him/her.
- Acknowledgement
- Table of contents
- List of Tables and Graphs
- Executive summary
- **Chapter 1** Introduction: Introduction about the Internship, Topic chosen for study, Need for the study, Objectives of the study, Scope of the study, Methodology adopted, Literature review and Limitations of the study
- **Chapter 2:** Industry profile and company profile: (Promoters, Vision, Mission & Quality Policy, Products / Services profile, Areas of Operation, Infrastructure facilities, Competitors' information, SWOT analysis, Future growth and prospects and Financial Statement
- **Chapter 3:** Theoretical background of the study – elaborative information on the subject chosen for better understanding and usage in the analysis.
- **Chapter 4:** Analysis and interpretation of the data Collected with relevant tables and graphs. Results obtained by using statistical tools must be included.

- **Chapter 5:** Summary of Findings, Conclusion and Suggestions / recommendations.
- Bibliography
- Annexure relevant to the project such as figures, graphs, photographs etc.

Marks allocation for IV Semester Internship report (12 MBA47)

Evaluation by Internal Guide

Sl No	Aspects	Marks
1	First presentation	15
2	Second presentation	15
3	Third presentation	20
4	Introduction and Methodology	10
5	Industry and Company profile	5
6	Theoretical Background of the Study	5
7	Data Analysis and interpretation	20
8	Summary of Findings, suggestions and Conclusion	10
	Total	100

Evaluation by a faculty member drawn from VTU institutions

Sl No	Aspects	Marks
1	Introduction and Methodology	20
2	Industry and Company profile	10
3	Theoretical Background of the Study	10
4	Data Analysis and interpretation	40
5	Summary of Findings, suggestions and Conclusion	20
	Total	100

Viva-voce conducted by HOD and an expert drawn from VTU institutions

SI No	Aspects	Marks
1	Presentation Skills	10
2	Communication Skills	10
3	Subject Knowledge	20
4	Objective of the study/Methodology	20
5	Analysis using Statistical tools and Statistical Packages	20
6	Findings and appropriate suggestions	20
	Total	100

Formats for Internship (Project) Report and Evaluation

- Format of Cover Page
- Format of certificate by College/Institution
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

Internship Report on

(Title of the Report)

BY

(Student Name)

(USN)

Submitted to

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

In partial fulfillment of the requirements for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION

Under the guidance of

INTERNAL GUIDE

EXTERNAL GUIDE

**(Name)
(Designation)**

**(Name)
(Designation)**

(Institute Logo)

Department of MBA

(Institute name with Address)

(Batch)

CERTIFICATE

This is to certify that **(Name of the Student)** bearing USN (xxxx) , is a bonafide student of Master of Business Administration course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgaum. Internship report on **“(Title of Report)”** is prepared by him/her under the guidance of **(Name of the Guide)**, in partial fulfillment of the requirements for the award of the degree of Master of Business Administration of Visvesvaraya Technological University, Belgaum Karnataka.

Signature of Internal Guide
Principal

Signature of HOD

Signature of

DECLARATION

I, **(Student Name)** , hereby declare that the Internship report entitled “(Title) ”with reference to “(Organisation with place)” prepared by me under the guidance of (Guide Name) , faculty of M.B.A Department, (Institute name) and external assistance by **(External Guide Name, Designation and Organisation)**.

I also declare that this Internship work is towards the partial fulfillment of the university regulations for the award of degree of Master of Business Administration by Visvesvaraya Technological University, Belgaum.

I have undergone a summer project for a period of Twelve weeks. I further declare that this project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University/Institution.

Place:

Signature of the student

Date:

TABLE OF CONTENTS

Executive Summary

Chapter 1.Introduction.....(Page Number)

Chapter 2.Industry and Company profile.....(Page Number)

Chapter 3. Theoretical Background of the Study(Page Number)

Chapter .4 Data Analysis and interpretation.....(Page Number)

Chapter .5 Summary of Findings, suggestions and Conclusion .(Page Number)

Bibliography

Annexure

LIST OF TABLES

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Table-4.1	Table showing ABC Analysis	
Table-4.2	Table showing FSN Analysis	
Table-4.3	Table showing EOQ	
Table-4.4	Table showing Stock of Raw Materials	

LIST OF FIGURES AND CHARTS

Chart No	Particulars	Page Numbers
Chart-4.1	Graph showing ABC Analysis	
Chart-4.2	Graph showing FSN Analysis	
Chart-4.3	Graph showing EOQ	
Chart-4.4	Graph showing Stock of Raw Materials	
Chart -4.5	Graph showing Raw Materials Turn Over Ratio	

BIBLIOGRAPHY

BOOKS:

1. Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.

ARTICLES:

1. Name of the Author, Title of the article, Name of the Journal, Volume Number, Issue Number, Year, Page Number (pp)

WEBLIOGRAPHY

2. Name of the Author, Title of the article, retrieved on mm/dd/yy, from URL

Visvesvaraya Technological University

Internal Evaluation Marks sheet for Internship report (12 MBA47)

Name of the College/Institution

Marks Allocation:

SI No	Aspects	Marks
1	First presentation	15
2	Second presentation	15
3	Third presentation	20
4	Introduction and Methodology	10
5	Industry and Company profile	5
6	Theoretical Background of the Study	5
7	Data Analysis and interpretation	20
8	Summary of Findings, suggestions and Conclusion	10
	Total	100

Marks Sheet:

SI No	USN	1	2	3	4	5	6	7	8	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Signature of the Guide with Date

Visvesvaraya Technological University

External Evaluation Marks sheet for Internship report (12 MBA47)

Name of the College/Institution

Marks Allocation:

Sl No	Aspects	Marks
1	Introduction and Methodology	20
2	Industry and Company profile	10
3	Theoretical Background of the Study	10
4	Data Analysis and interpretation	40
5	Summary of Findings, suggestions and Conclusion	20
	Total	100

Marks Sheet:

Sl No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Signature of external Examiner with Affiliation

Visvesvaraya Technological University

Viva-Voce marks sheet for Internship report (12 MBA47)

Name of the College/Institution

Marks Allocation:

SI No	Aspects	Marks
1	Presentation Skills	10
2	Communication Skills	10
3	Subject Knowledge	20
4	Objective of the study/Methodology	20
5	Analysis using Statistical tools and Statistical Packages	20
6	Findings and appropriate suggestions	20
	Total	100

Marks Sheet:

SI No	USN	1	2	3	4	5	6	Total
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Signature of external Examiner with Affiliation

Signature of HOD

- Entrepreneurship Development and Management - Vasant Desai - Himalaya Publishing House - 2007
- Entrepreneurship-Theory and Practice - Raj Shankar Vijay Nicole Imprints Pvt. Ltd - 2006
- Entrepreneurship - Rajiv Roy - 2/e - Oxford University Press 2011
- Entrepreneurship-Principles and Practices - Kurakto - 7/e - Thomson Publication - 2007

SEMESTER III MARKETING SPECIALISATION

CONSUMER BEHAVIOR

Subject Code	: 16MBA MM301	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To understand the concept of consumer behavior, decision making by consumers, behavioral variables and its influences on consumer behavior.
- To comprehend the social and cultural dimensions of consumer behavior.
- To provide an insight of the psychological and behavioral concepts of consumers.

Outcomes:

The student should be able to:

- Explain the background and concepts vital for understanding Consumer Behaviour.
- Identify the role of variables that determines Consumer Behaviour in Social & cultural domain.
- Identifying the psychological and behavioral practices adopted by organizations to enhance the Consumer Behaviour.

Unit 1:

(5 Hours)

Introduction to the study of Consumer Behaviour: Meaning & Definition of CB, Difference between consumer & Customer, Nature & characteristics of Indian Consumers, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.

Unit 2:

(9 Hours)

Role of Research in understanding consumer behaviour: Consumer Research: Consumer Research Paradigms (Qualitative & Quantitative Research Methods) Developing research objectives, collecting secondary data, designing primary research, data analysis and reporting research findings.

Models of Consumer Behaviour: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences: Motivation, Personality, Perception, Learning, Attitude, Communications, External Influences: Social Class, Culture, REFERENCE Groups, Family members.

Levels of Consumer Decision Making – Consumer Buying Decision Process, Complex Decision Making or Extensive Problem Solving Model, Low Involvement Decision Making or Limited Problem Solving Model, Routinised Response Behaviour, Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages
Situational Influences- Nature of Situational Influence (The communication Situation, The Purchase Situation, The usage situation, The disposition situation) Situational Characteristics and consumption behaviour (Physical features, Social Surroundings, Temporal Perspectives, Task Definition, Antecedent States.)

Unit 3:

(10 Hours)

Individual Influences on Consumer Behaviour and CRM: Part 1

A) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals.

Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives (Cognitive Preservation Motives, Cognitive Growth Motives, Affective Preservation Motives, Affective Growth Motives).

B) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity (Consumer Innovativeness and related personality traits, Cognitive personality factors, Consumer Materialism, Consumer Ethnocentrism), Brand Personality (Brand Personification, Gender, Geography, Colour), Self and Self-Image (One or Multiple selves, The extended self, Altering the self).

C) Perception: Basics of Perception & Marketing implications, Elements of Perception (Sensation, Absolute Threshold, Differential Threshold, Subliminal Perception), Dynamics of Perception (Perceptual Selection, Perceptual Interpretation, Perceptual Organization, perceived price, perceived quality, price/quality relationship, Perceived Risk, Types of risk, How consumers' handle risk.

Customer Relationship Management

Meaning & Significance of CRM, Types of CRM (Operational, Collaborative, Analytical), Strategies for building relationship marketing, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e-CRM

Unit 4:

(08 Hours)

Individual Influences on Consumer Behaviour: Part 2

A) Learning: Elements of Consumer Learning, Motivation, Cues, Response, Reinforcement, Marketing Applications of Behavioural Learning Theories, Classical Conditioning Pavlovian Model, Neo-Pavlovian Model), Instrumental Conditioning, Elaboration Likelihood Model.

B) Attitude: Basics of attitude, the nature of attitude, Models of Attitude and Marketing Implication, (Tri-component Model of attitude, Multi attribute attitude models.

C) Persuasive Communication: Communications strategy, Target Audience, Media Strategy, Message strategies, Message structure and presentation.

Unit 5:

(12 Hours)

External Influences on Consumer Behaviour

Social Class: Social Class Basics, What is Social Class? (Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India

Culture and Subculture - Major Focus on Indian Perspective

Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour.

Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures

Cross-cultural consumer analysis: Similarities and differences among people, the growing global middle class; Acculturation is a needed marketing viewpoint, applying research techniques Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Strategies to overcome cross-cultural problems.

Groups: Meaning and Nature of Groups, Types

Family: The changing structure of family, Family decision making and consumption related roles, Key family consumption roles, Dynamics of husband-wife decision making, The expanding role of children in family decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications,

Reference Groups: Understanding the power & benefits of reference groups, A broadened perspective on reference groups, Factors that affect reference group influence, Types of reference groups, Friendship groups, Shopping groups, Work groups, Virtual groups, Consumer-action groups, reference group appeals, Celebrities.

Unit 6:

(08 Hours)

Consumer Influence and Diffusion of Innovations

Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders

Diffusion of Innovations: Diffusion Process (Innovation, Communication channels, Social System, Time) Adoption Process: Stages, categories of adopters Post Purchase Processes: Post Purchase Processes, Customer Satisfaction, and customer commitment: Post purchase dissonance, Product use and non use, Disposition, Product disposition.

Case studies in Indian context only

(04 Hours)

Practical Component:

- Students can go to malls and unorganized retail outlets and observe the behavior of consumers of different demographic segments while buying different category of goods. Come back to class and present the findings / observations followed with a group discussion.
- Students can prepare a questionnaire and do a survey on consumer buying behavior and present the findings in the class.
- Find three advertisements that appeal to the need for power, affiliation and achievement and discuss their effectiveness. Rewrite these for persons in different levels of Maslow's Hierarchy?
- Meet your friends and conduct a survey to find what are the important factors in their purchase of mobiles, shoes, bags etc. There are now plenty of advertisements regarding most products – how do they deal with this information overload?.

RECOMMENDED BOOKS:

- Consumer Behavior - Leon Schiff man, Lesslie Kanuk, 10/e, Pearson, 2010.
- Consumer Behaviour: A Managerial Perspective, Dr. Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal, 1/e, Cengage Learning
- Consumer Behavior: Building Marketing Strategy – Del I. Hawkins, & Others, 11/e, TMH,
- Consumer behavior - Jay D. Lindquist, Joseph Sirgy, 1/e, Cengage Learning.
- Consumer Behavior in Indian Perspective – Suja Nair, Himalaya Publications

REFERENCE BOOKS:

- Consumer Behavior - Henry Asseal, Cengage Learning.
- Consumer Behavior- Satish K. Batra & S H HKazmi, Excel Books.
- CRM – Alok Kumar, Chhabi Sinha, 7/e, Biztantra.
- Customer Relationship Management - Peru Ahamed & Sagadevan, Vikas Publishing.
- Consumer Behavior – Kumar Rajeev, Himalaya Publisher.

RETAIL MANAGEMENT

Subject Code	: 16MBA MM302	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop an understanding of the contemporary retail management, issues, strategies and trends.
- To highlight the importance of retailing and its role in the success of modern business.
- To acclimatize with the insights of retailing, key activities and relationships.

Outcomes:**The student should be able to:**

- Find out the contemporary retail management, issues, and strategies.
- Evaluate the recent trends in retailing and its impact in the success of modern business.
- Relate store management and visual merchandising practices for effective retailing.

Unit 1:**(8 Hours)**

Introduction and Perspectives on Retailing World of Retailing, Retail management, introduction, meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) - Multichannel Retailing - Customer Buying Behaviour, Historical Perspective, role of retailing, trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario

Unit 2:**(5 Hours)****Theories of Retailing**

Wheel of retailing, The Retail Accordion, Melting Pot Theory, Polarization theory.

Unit 3: (14 Hours)

Retailing strategy for Setting up Retail organization and planning: Retail Market Strategy - Financial Strategy - Site & Locations (Size and space allocation, location strategy, factors Affecting the location of Retail, Retail location Research and Techniques, Objectives of Good store Design.) – Human Resource Management, Information Systems and supply chain management & Logistics.

Retail Pricing and Promotion: Factors influencing retail pricing, Retail pricing strategies, Retail promotion strategies.

Unit 4: (10 Hours)

Store Management and Visual Merchandising:

Store Management: Responsibilities of Store Manager, Store Security, Parking Space Problem at Retail Centres, Store Record and Accounting System, Coding System, Material Handling in Stores, Management of Modern retails –Store Layout, design: Types of Layouts, role of Visual Merchandiser, Visual Merchandising Techniques, Controlling Costs and Reducing Inventories Loss, Exteriors, Interiors Customer Service, Planning Merchandise Assortments -Buying systems -Buying merchandise and Retail Communication Mix.

Unit 5: (9 Hours)

Relationship Marketing & International Retailing: Management & Evaluation of Relationships in Retailing, Retail Research in Retailing: Importance of Research in Retailing, Trends in Retail Research, Areas of Retail Research. Customer Audits, Brand Management in retailing, Internationalization of Retailing and Evolution of International Retailing, Motives of International Retailing, International Retail Environment – Socio-Cultural, Economic, Political, Legal, Technological and issues in international retailing

Unit 6: (6 Hours)

Retail Audit and ethics in Retailing

Undertaking an audit, responding to a retail Audit, problems in conducting a retail audit. Ethics in retailing, social responsibility and consumerism

Case Studies (4 Hours)

Practical Components:

- Interview a salesperson in a retail store and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why they chose a sales career, and what does it take to succeed in this profession.
- Go to a kirana store and a supermarket and compare the following: a) store arrangement b) No of brands carried c) pricing policies – are discounts given? d) Service – personal or impersonal? Etc.
- Go to at least three kirana stores in your neighborhood (around 2 kms) and discuss with them the importance of location, pricing, credit policy, etc. What percentages of goods are sold 'loose' in each locality and compare this with the approximate income range of

the customers? What are the retailer's losses when a customer defaults in payment? Does he make up for it by increasing his prices to other customers?

- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products into low risk and high risk ones. Does this buying behavior also depend on the personality of the individual doing the buying? Or the one doing the selling?
- Student can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.

RECOMMENDED BOOKS:

- Retail Management - Levy & Weitz, 8/e, TMH, 2012.
- Retail Management - Chetan Bajaj, Oxford University press.
- Retailing, James R Carver, Patrick m Dunne, Robert F Lusch, 8/e
- Retail Marketing Management - Dravid Gilbert, 2/e, Pearson Education.
- The Art of Retailing - A. J. Lamba, McGraw Hill.

REFERENCE BOOKS:

- Integrated Retail Management - James R. Ogden & Denise Trodden, Biztantra, Latest Edition.
- Principles of Retail Management - Rosemary Varley, Mohammed Rafiq, Palgrave Macmillan, 2009.
- Managing Retailing - Sinha, Piyush Kumar & Uniyal & Oxford University Press, 2010.
- Retailing Management - Swapna Pradhan, 4/e, TMH, 2012.
- Retail Management: A Strategic Approach - Barry Berman, Joel R. Evans, Pearson.
- Retail Management, Functional Principles and Practices, Gibson G Vedamani, 4th Edition, JAICO Publishing House.
- Retail Management, Global perspective, Dr. Harjith Singh, 3rd Revised Edition, S.Chand.

SERVICES MARKETING

Subject Code	: 16MBA MM303	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To acquaint the students with the characteristics of services and their marketing implications.
- To discuss and conceptualize the service quality, productivity in services, role of personnel in service marketing and to manage changes in the environment.
- To familiarize the students with the GAPS model and strategizing towards closing the GAPS for effective services marketing.

Outcomes:

The student should be able to:

- Develop an understanding about the various concepts and importance of Services Marketing.
- Enhance knowledge about emerging issues and trends in the service sector
- Learn to implement service strategies to meet new challenges

Unit 1: (10 Hours)

Introduction to services: Concepts, contribution and reasons for the growth of services sector, difference in goods and service in marketing, characteristics of services, concept of service marketing triangle, service marketing mix, GAP models of service quality.

Consumer behaviour in services: Search, Experience and Credence property, consumer expectation of services, two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services.

Customer perception of services-Factors that influence customer perception of service, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

Unit 2: (8 Hours)

Understanding customer expectation through market research: Key reasons for GAP 1, using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies –Relationship marketing, Evaluation of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services.

Unit 3: (10 Hours)

Customer defined service standards: “Hard” & “Soft” standards, challenges of matching supply & demand in capacity, four common types of constraints facing services, optimum v/s maximum use of capacity, strategies for matching capacity & demand.

Yield management-balancing capacity utilization, pricing. Waiting line strategies- four basic Waiting line strategies.

Leadership & Measurement system for market driven service performance-key reasons for GAP-2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing.

Unit 4: (8 Hours)

Employee role in service designing: importance of service employee, Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3.

Customer’s role in service delivery-Importance of customer & customer’s role in service delivery, Strategies for enhancing-Customer participation, Delivery through intermediaries-Key intermediaries for service delivery, Intermediary control strategies.

Unit 5: (8 Hours)

Role of marketing communication-Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery, Methodology to exceed customer expectation.

Pricing of services-Role of price and value in provider GAP 4, Role of non-monitory cost, Priceas an indicator of service quality –Approaches to pricing services, pricing strategies.

Unit 6: (6 Hours)

Physical evidence in services: Types of service spaces- Role of service scapes, Frame work forunderstanding service scapes& its effect on behaviour-Guidance for physical evidence strategies.

Case Studies in Indian context only (6 hours)

Practical component:

- Ask students to choose a service industry of their choice at the beginning of the semester
- Ask them to do an in-depth study of the industry and give a presentation at the end of theevery Module relating to the concepts of that Module to the industry
- Students can prepare service blueprints for any service of their choice
- Students can do a role play on service recovery
- Identify any existing services. Locate loopholes in their design and suggest modifications

RECOMMENDED BOOKS:

- Services Marketing-Valarie A Zeithmal& Mary Jo Bitner, 5/e, TMH, 2011
- Services Marketing-Christopher Lovelock, Pearson Education.

REFERENCE BOOKS:

- Services Marketing - RajendraNargundkar, 3/e, TMH, 2010
- Services Marketing - GovindApte, Oxford.
- Services Marketing - Hoffman & Bateson, 4/e, Cengage Learning-2007
- Services Marketing: Operation, Management and Strategy-Kenneth E Clow& David L. Kurtz, 2/e, Biztantra, 2007

MARKETING RESEARCH

Subject Code	: 16MBA MM304	IA Marks : 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To provide an understanding of the basics of marketing research process.
- To orient on the theoretical and practical aspects of marketing research.
- Encourage the students to take up analytical thinking through research.
- To highlight importance marketing research for enhancing marketing strategies.

Outcomes:

The student should be able to:

- Comprehend the objectives of Market research & its application in solving marketing problems

- Appreciate the use of different data collection methods, sampling design techniques, measurement methods to analyze the data.
- Generalize and interpret the data with the help of various measurement techniques.
- To understand the emergence of new trends in research.

Unit 1: (8 Hours)

Introduction: Meaning, scope and importance of marketing research; own vs. agency marketing research; marketing information system; meaning, need and components, marketing information system and marketing research; marketing research process-an overview; problem definition, formulation and preparation of research proposal.

Unit 2: (10 Hours)

Research Design and Data Collection

Research Design: Meaning and scope of research design; types of research designs, exploratory, descriptive and conclusive

Secondary Data: Sources and uses of secondary data, collection of secondary data.

Primary Data Collection: Primary data collection methods; mail survey, telephone survey and interviews and their evaluation; observations; experimental methods, questionnaire administering, organizing fieldwork for collecting data.

Unit 3: (9 Hours)

Sample Design and Sampling: Determining universe, sampling frame and sampling unit; determining sampling method; sample size determination; sampling errors vs. non-sampling errors.

Sampling: Steps & Types: Probability / non probability (simple, systematic; stratified proportionate, disproportionate), Sample size determination

Unit 4: (9 Hours)

Questionnaire design: Steps in Q.D. with examples for each step. Rating Scales, Juster, Likert, Semantic Differential, Thurston, Attitude Scales, Scales for illiterate respondents

Unit 5: (10 Hours)

Measurement Techniques: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale; Scale Types: Comparative Scaling, Non-comparative Scaling; Attitude Measurement, Self-Reporting Methods, Methods for Rating Attributes, Data Analysis, Customer Research, Advertising Research, Product Research, Distribution Research, Sales Research, Marketing Environment Research, Internet Marketing Research, and International Marketing Research

Unit 6: (10 Hours)

Research trends, Behavioral Science Based Approach, Economic and Competitive Pressures, Consumer Insight Groups, Quantifying Emotions, Impact of the Social Media, Do-it-Yourself (DIY) Research; Research ethics, typical research errors, Research and culture;

Practical Components:

- Choose 5 successful products or services and identify the insight behind them through a field survey.
- Do a comprehensive essay on the difference between consumer vs. trade vs. competition insights & how best to exploit them.
- Take 5 recent digital innovations e.g. twitter or face book and identify the insights. Locate 5 non-users of search or mail and Interview their reasons.
- Choose 5 recent successful campaigns and identify their insights through consumer interviews. Present your findings to the class
- Choose 3 successful movies e.g. Dabang & Zindaginamilegi & My name is Khan---and interview consumers about the reasons for their success. Similarly repeat this with 3 recent expensive flop movies and Present your findings to the class

RECOMMENDED BOOKS:

- Marketing Research contemporary approach- Naraynreddy and GVRK Acharyalu, Excel publications
- Marketing Research and consumer Behavior Saravanel et.al, Vikas publishing house
- Essentials of Marketing Research – 4/e, Tony Proctor, PHI, 2005
- Essentials of Marketing Research – William G. Zikmund et.al. 4/e, Cengage Learning, 2010.
- Research Skills for Students: Transferable and Learning Skills - Allison, et.al. 1996.
- Market Research – Aekar, 11/e, Wiley publications, 2002.

REFERENCE BOOKS:

- Market Research: a guide to planning, methodology & evaluation - Paul Hague, KoganPage, 1996.
- Market Research Best Practice. 30 Visions of the Future – Peter Mouncey, et.al, 2007.

BUSINESS MARKETING

Subject Code	: 16MBA MM305	IA Marks: 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop an understanding of the various concepts of Industrial Marketing.
- To understand the buying process and marketing channels for industrial goods.
- To acquaint with B-2-B-2-C Strategies and their implementation.
- To analyze various pricing strategies of industrial goods & their implications.
- To understand the significance of E-commerce in Business Marketing.

Outcomes:

The student should be able to:

- Describe the nature of business markets and the related concepts.
- Familiarize the business buying behavior of industrial customers.
- Analyze business situations in the context of buyer-seller relationships.
- Apply concepts of pricing strategies for industrial goods

- To evaluate the significance of E –Commerce in Business Marketing.

Unit 1: (8 Hours)

Nature of Business Marketing: Business Marketing Concept, Business vs. Consumer Marketing, Economics of Industrial demand, Types of Industrial Markets, Types of Business Customers, Classifying Industrial Products & Services, Business customers purchase orientations, Organizational Procurement Characteristics, Environment Analysis in Business Marketing.

Units 2: (10 Hours)

Organizational Buying Behaviour: Organizational Buying Process, Types of purchases / buying situations, Buying Centre Concept, Inter Personal Dynamics of Business Buying Behaviour, Roles of Buying centre, Conflict Resolution in Decision, The Webster & Wind model of Organizational Buying Behaviour, Ethics in Purchasing.

Business Marketing Research: Differences between B2C & B2B Marketing Research, Marketing Research Process, The Standard Industrial Classification (SIC), Research Methods, Sales Forecasting Approaches, Top-Down, Bottom-up approaches.

Unit 3: (8 Hours)

Market Segmentation: Segmenting, Targeting and Positioning of Business Market, Value based segmentation, Model for segmenting the organizational Market.

Product & Brand Strategy: Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products, Branding process & Brand strategy.

Business Service Marketing: Special Challenges

Unit 4: (8 Hours)

Formulating Channel Strategy: Nature of Business Marketing channels, Intermediaries, Direct and Indirect Channels, Channel Objectives, Channel Design, Managing Channel Members, Selection and Motivation of Channel Members, Channel conflicts, SCM, Logistics Management, Customer Service, Major cost centres of Market Logistics.

Unit 5: (8 Hours)

Pricing Strategies: Price Determinants, Factors that Influence the Pricing Strategies, Pricing Methods, concept of learning curves, Pricing Strategies, Pricing Policies, Terms of Payment, Competitive Bidding, Leasing

The Promotional Strategies: Communication Objectives, Role of B-2-B Advertising, Sales Promotion in Industrial Markets, Trade shows and Exhibitions.

Unit 6: (10 Hours)

Management of Sales Force: Personal Selling, The Selling Process, Key Account Management, Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for sales force Deployment, Measuring the Effectiveness of Sales Force, Customer relationship Management Strategies for Business Markets, Ethical Issues.

B2B through E-Commerce: Business-to-Business forms of E-Commerce, Models for B2B ecommerce, Marketing strategy for the electronic market place.

Case Studies in Indian context only.

(4 Hours)

Practical Components:

- Group presentations on organizational buying behavior & practices in purchase of raw materials, capital & facilitating goods in Indian Co's & MNC's operating in India.
- Segmentation & Positioning of B2B Products.
- Forecasting Techniques for demand of Industrial Products
- Visit to Trade shows & Exhibitions
- Industry visit in 2-3 Industries
- Competitive Bidding Process
- Preparation of quotation.
- Industry survey in the context of B2B Marketing
- Case studies

RECOMMENDED BOOKS:

- Business Marketing – Krishna K Havaldar, Latest Edition, Tata McGraw Hill Publication.
- Industrial Marketing – Robert R Reeder & Reeder; 2nd Edition; Prentice-Hall International Publication.
- Business Marketing Management – Michael D Hutt, Thomas W Speh, Latest Edition, Cengage Learning Publication.

REFERENCE BOOKS:

- Business Marketing – Frank G Bingham Jr., Latest Edition; Tata McGraw Hill Publication.
- Industrial Marketing – Mukherjee H S; Latest Edition; Excel BOOKS Publication.
- Industrial Marketing – PK Ghosh, Latest Edition; Oxford University Press.

SUPPLY CHAIN MANAGEMENT

Subject Code	: 16MBA MM306	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives:

- To understand the basic concepts, processes and key elements of a supply chain.
- To provide insights for establishing efficient, effective, and sustainable supply chains.
- To explain the role of technology in supply chain planning, visibility, and execution.

Outcomes:

The student should be able to:

- Demonstrate knowledge of the functions of logistics and supply chain management.
- To relate concepts and activities of the supply chain to actual organizations.
- Highlight the role of technology in logistics and supply chain management.

- Evaluate cases for effective supply chain management and its implementation.

Unit 1: (7 Hours)

Introduction: Basic concepts & philosophy of SCM, essential features, decision phases – process view, supply chain framework, key issues in SCM and benefits.

Unit 2: (8 Hours)

Designing the supply chain network: Designing the distribution network, role of distribution, factors influencing distribution, design options, distribution networks in practice, network design in the supply chain, factors affecting the network design decisions. Designing and Planning Transportation Networks, role of transportation, modes and their performance, transportation Infrastructure and policies, design options and their trade-offs, tailored transportation.

Unit 3: (10 Hours)

Inventory Management: Concept, various costs associated with inventory, EOQ, buffer stock, lead time reduction, reorder point / re-order level fixation, ABC analysis, SDE/VED Analysis. [Simple problems only for understanding the concept]

Unit 4: (8 Hours)

Purchasing and vendor management: Centralized and decentralized purchasing, function of purchase department and purchase policies, vendor rating/ evaluation, single vendor concept, management of stores, account for materials, just in time & Kanban systems of inventory management

Unit 5: (10 Hours)

Logistics Management: Logistics of part of SCM, logistics costs, different models, logistics, sub-systems, inbound and out bound logistics bullwhip effects in logistics, distribution and warehousing management. Demand Management and Customer Service: Demand Management, traditional forecasting, CPFRP, customer service, expected cost of stockouts.

Unit 6: (8 Hours)

Recent issues in SCM: Role of computer/ IT in supply chain management, CRM Vs SCM, Benchmarking concept, features and implementation, outsourcing – basic concepts, value addition in SCM – concept of demand chain management

Case Studies in Indian context only. (5 Hours)

Practical Components:

- Students are expected to choose any 2 Indian Organization and study their supply chain in terms of drivers of the Supply chain and submit a report
- Students can study different logistics companies and services provided by them.
- Students can identify any product/service and study the type of distribution system used and understand the reason for using that particular type.
- Students can identify the various types of IT applications employed by Indian Organizations in their Supply chain.

RECOMMENDED BOOKS:

- Supply chain management, Chopra Sunil and Peter Meindl - 3rd edition, Pearson, 2007.
- A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, 1st Edition, Cengage Learning.
- Supply Chain Logistics Management, Donald J Bowersox, Dand J Closs, M Bixby Coluper, 2nd Edition, TMH, 2008.
- Supply Chain Management-A Managerial Approach, Amith Sinha, Herbert, 2nd edition, TMH.

REFERENCE BOOKS:

- Logistics and supply chain management, G. Raghuram (I.I.M.A.), Macmillan, 2000
- Harnessing value in supply chain, Emiko Bonafield, John Wiley, Singapore, 1999
- Material Management rearview, Dr. Gopal Krishnan, Pearson New Delhi, 2002
- Supply Chain Management, B.S. Sahay, Macmillan, Pearson Education, 2004
- A Text Book of Logistics and Supply chain management, Agarwal D.K. - 1st edition, Macmillan.

Semester: III Finance Specialisation

PRINCIPLES AND PRACTICES OF BANKING

Subject Code	: 16MBA FM301	IA Marks: 20
Number of Lecture Hours/Week:	03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To discuss the Structure and System of Banking in India
- To discuss the features of Negotiable Instrument Act of 1881
- To familiarize the students with Universal Banking
- To discuss the Asset Liability Management in banks

Course Outcomes:

At the end of the course students are able to:

- Understand the banking system in India
- Know the nature of banker – customer relationship
- Make use of Negotiable instruments practically
- Have familiarity in using banking technologies like internet banking, Mobile banking, NEFT, ECS etc.
- Understand the concept of international banking and management of asset and liability in banks

Unit 1:**(10 Hours)**

Banking system and structure in India- Evolution of Indian Banks-Types of banks - Public Sector, Regional Banks, Performance of Public Sector banks, Private Sector Banks.

Commercial banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio economic development, Services rendered. Credit creation and Deployment of

Funds.-Role of Reserve Bank and GOI as regulator of banking system – Provisions of Banking Regulation Act & Reserve Bank of India Act.

Unit 2: (10 Hours)

Banker and customer – Types of relationship between banker and customer – Bankers obligations to customers – Right of lien, setoff, appropriation–Bankers legal duty of disclosure and related matters.

Customers` accounts with banks – Opening- operation – KYC norms and operation –Types of accounts and customers – Nomination – Settlement of death claims.

The Negotiable Instruments Act 1881: The Paying Banker and The Collecting Banker- Negligence-Bills of exchange and promissory note-Discharge of Negotiable instruments- Hundis.

Unit 3: (10 Hours)

Banking Technology- Concept of Universal Banking-Home banking–ATMs-Internet banking– Mobile banking-Core banking solutions–Debit, Credit and Smart cards– Electronic Payment systems-MICR- Cheque Truncation-ECS- EFT – NEFT-RTGS.

Unit 4: (9 Hours)

International banking–International Banking: Exchange rates and Forex Business, Correspondent banking and NRI Accounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers, Role of ECGC, RBI and EXIM Bank.

Unit 5: (8 Hours)
Banker as lender – Types of loans – Overdraft facilities – Discounting of bills – Financing book dates and supply bills- Charging of Security bills- pledge – mortgage – assignment

Unit 6: (9Hours)

Asset Liability Management (ALM) in banks: Components of Liabilities and Components of Assets, Significance of Asset Liability management, Purpose and objectives. Prerequisites for ALM, Assets and Liabilities Committee (ALCO)- Activities of ALCO

Practical Components:

- Students can study Universal Banking & Cross Selling concepts adopted by banks
- Students can study Customer Profiling aspects adopted by banks
- Students can analyze Advertisement & Publicity efforts done by banks using ATMs (making a checklist of the publicity material found in an ATM – preferably in a private bank ATM)

RECOMMENDED BOOKS:

- Principles and practices of Banking - IIBF, 2/e, Macmillan, New Delhi.
- Elements of Banking & Insurance – JyothsnaSethi&Nishwan Bhatia, PHI, 2009.
- Bank Management - Koch W, Timothy, & S. Scott, Cengage Learning, New Delhi.

- Management of Banking and Financial Services, Padmalatha Suresh and Justin Paul, Second edition, Pearson, 2011
- Banking Theory and Practice, K.C. Shekhar and LekshmyShekhar, Vikas Publishing House,2011.
- Modern Banking: Theory and Practice, Muraleedharan D, PHI,2013.

REFERENCE BOOKS:

- Banking Theory, Law and practice - Sunderaram and Varshney, Sultan Chand & Sons, New Delhi.
- Banking and Financial System - Prasad K, Nirmala, Chandradas J. Himalaya Publishing House, Mumbai.
- Banking and Financial services- Sharma, Mukund, 1st edition, Himalaya Publishing House, Mumbai.

INVESTMENT BANKING AND FINANCIAL SERVICES

Subject Code	: 16MBA FM302	IA Marks: 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To provide an understanding of the functioning of investment banking
- To explain the role of depositories and custodians
- To provide an in depth understanding of the financial services like factoring, venture capital, leasing and hire purchase.
- To familiarize the students with working of Housing finance and non banking finance companies
- To explain the concept and developments in micro finance, credit rating and securitization

Course Outcome:

At the end of the course, the students are able to:-

- Understand the functioning of Investment banking
- Be aware of operation connected with depositories and custodians
- Know how financial services like factoring, venture capital, leasing and hire purchase are provided in the financial system.
- Understand the working of Housing finance and non-banking finance companies.
- Identify the developments happening in micro finance, credit rating and securitization system.

Unit 1:

(10 Hours)

Investment Banking- Introduction-Functions of Investment Banks- Types of Investment Banks- Investment Banking Services- Merchant Banking Services-Issue Management-Pre issue and Post

issue obligations-Changing landscape of Investment Banking. Regulation of the Capital Market-SEBI regulations for merchant bankers, brokers and sub brokers, intermediaries and portfolio managers.

Underwriting: Concept – Devolvement - Business model - Underwriting in fixed price offers and book built offers.

Unit 2: (9 Hours)

Depository System: Objectives, activities, interacting systems, role of depositories and their services, Advantages of depository system -NSDL and CDSL. The process of clearing and settlement through Depositories, Depository Participants.

Regulations relating to Depositories-SEBI (Depositories and Participants) Regulations 1996-Registration of depository and participant- Rights and Obligations of depositories and Participants.

Unit 3: (7 Hours)

Housing Finance: Role, Types of housing loans, Institutions and banks offering Housing Finance, Procedure and Interest rates. Income Tax Implication. Reverse mortgage loan.

Non-Banking Finance Companies: Types, Growth, Functions, RBI Guidelines, Prudential Norms.

Unit 4: (9 Hours)

Factoring: Origin, Types, Factoring mechanism, advantages, factoring charges, International factoring, Factoring in India. **Forfeiting:** Origin, characteristics, benefits, difference between factoring and forfeiting, growth of forfeiting in India. **Securitization of debt:** Meaning, Features, Special Purpose Vehicle, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.

Unit 5: (9 Hours)

Venture Capital: Concept, features, Origin and the current Indian Scenario. Private equity-Investment banking perspectives in private equity

Microfinance: The paradigm - NGOs and SHGs - Microfinance delivery mechanisms – Future of micro finance.

Credit rating: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of different companies. Rating agencies for SMEs.

Unit 6: (12 Hours)

Leasing: Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and disadvantages of Leasing, Contents of a Lease Agreement, Matters on Depreciation and Tax, Problems in leasing, Factors influencing Buy or Borrow or Lease Decision.

Hire Purchasing: Concepts and features, Hire Purchase Agreement, Comparison of Hire Purchase with Credit sale, Instalment sale and Leasing. Banks and Hire Purchase. Problems related to outright purchase, Hire purchase and Leasing.

(Question Paper: Case study-Problem on financial evaluation of leasing and hire purchase.)

Practical Components:

- Students can study the procedure for the sanction of housing loans by a bank
- Students can study the Procedure to open a Demat account and an Online Trading Account.
- Students can visit a NBFC and study their operations
- Students may visit a SHG/NGO and study the micro finance aspects
- Visit a bank/financial institution providing factoring service and submit a report.

RECOMMENDED BOOKS:

- Indian Financial System—Khan M. Y, 7/e, TMH, 2011
- Indian Financial System – Machiraju, 4/e, Vikas, 2010
- Financial Markets and Services – Gordon & Natarajan, 7/e, Himalaya publishing, 2011.
- Financial services - Khan M.Y, 6/e, McGraw Hill, 2011.
- Banking and Financial services- Sharma, Mukund, 1/e edition, Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:

- Dynamics of Financial Markets and Institutions in India – Srivastava R. M, Excel Books, 2010.
- Indian Financial System – Bharati V. Pathak, 3/e, Pearson Education, 2011.
- Investment Banking- Pratap G Subramanyam, Tata McGraw Hill, 2012.
- Merchant Banking & Financial services - Vij&Dhavan, 1/e, McGraw Hill, 2011.

INVESTMENT MANAGEMENT

Subject Code	: 16MBA FM303	IA Marks: 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To develop a thorough understanding of the process of investments.
- To familiarize the students with the stock markets in India and abroad.
- To provide conceptual insights into the valuation of securities.
- To provide insight about the relationship of the risk and return and how risk should be measured to bring about a return according to the expectations of the investors.
- To familiarize the students with the fundamental and technical analysis of the diverse investment avenues
- To learn the Theories of Portfolio management and also the tools and techniques for efficient portfolio management.

Course Outcome:

At the end of the course, the students are able to:-

- Understand the process of investments.
- Get an insight into functioning of stock markets in India and abroad.
- Have insight into the relationship of the risk and return.
- Have familiarity of the fundamental and technical analysis
- Learn the Theories of Portfolio management and also the tools and techniques for efficient portfolio management.

Unit 1: (Theory)

(6 Hours)

Investment: Attributes, Economic vs. Financial Investment, Investment and speculation, Features of a good investment, Investment Process. Financial Instruments: Money Market Instruments, Capital Market Instruments, Derivatives. Mutual Funds: Functions of Investment companies, Classification of Investment companies, Mutual Fund types, Performance of Mutual Funds-NAV.

Unit 2: (Theory)

(6 Hours)

Securities Market: Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures, Leading Stock Exchanges in India. Stock Market Indicators- Types of stock market Indices, Indices of Indian Stock Exchanges.

Unit 3: (Theory & Problems)

(10 Hours)

Risk and Return Concepts: Concept of Risk, Types of Risk- Systematic risk, Unsystematic risk, Calculation of Risk and returns of individual security, Portfolio Risk and Return

Unit 4: (Theory & Problems)

(10 Hours)

Valuation of securities: Bond- Bond features, Types of Bonds, Determinants of interest rates, Bond Management Strategies, Bond Valuation, Bond Duration. Preference Shares- Concept, Features, Yields. Equity shares- Concept, Valuation, Dividend Valuation models

Unit:5 (Theory& Problems)

(12 Hours)

Macro-Economic and Industry Analysis: Fundamental analysis-EIC Frame Work, Global Economy, Domestic Economy, Business Cycles, Industry Analysis.

Company Analysis- Financial Statement Analysis, Ratio Analysis.

Technical Analysis – Concept, Theories- Dow Theory, Eliot wave theory. Charts-Types, Trend and Trend Reversal Patterns. Mathematical Indicators – Moving averages, ROC, RSI, and Market Indicators. (Problems in company analysis & Technical analysis)

Market Efficiency and Behavioral Finance: Random walk and Efficient Market Hypothesis, Forms of Market Efficiency, Empirical test for different forms of market efficiency. Behavioral Finance – Interpretation, Biases and critiques. (Theory only)

Unit 6: (Theory & Problems)

(12 Hours)

Modern Portfolio Theory: Markowitz Model -Portfolio Selection, Opportunity set, Efficient Frontier. Capital Asset pricing model: Basic Assumptions, CAPM Equation, Security Market line, Extension of Capital Asset pricing Model - Capital market line, SML VS CML. Arbitrage Pricing Theory: Arbitrage, Equation, Assumption, Equilibrium, APT AND CAPM.

Portfolio Management: Diversification- Investment objectives, Risk Assessment, Selection of asset mix, Risk, Return and benefits from diversification. Portfolio Management Strategies: Active and Passive Portfolio Management strategy. Portfolio Revision: Portfolio Revision Strategies – Objectives, Performance plans.

Portfolio Evaluation: Holding period's returns, Measures of portfolio performance. Sharpe's, Treynor's and Jensen's.

(QUESTION PAPER- 50% Problems, 50% Theory)

Practical Components:

- A Student is expected to trade in stocks. It involves an investment of a virtual amount of Rs.10 lakhs in a diversified portfolio and managing the portfolio. At the end of the Semester the Net worth is to be assessed and marks may be given (to beat an index).
- Students should study the functioning of stock exchange.
- Students can do:-
 - Macro Economic Analysis for the Indian economy.
 - Industry Analysis for Specific Sectors.
 - Company Analysis for select companies.
 - Practice Technical Analysis
- Students can study the mutual funds schemes available in the market and do their Performance evaluation.

RECOMMENDED BOOKS:

- Investments – ZviBodie, Kane, Marcus &Mohanty, 8/e, TMH, 2010.
- Investment Analysis and Portfolio management – Prasanna Chandra, 3/e, TMH, 2010.
- Security Analysis & Portfolio Management- Kevin S, PHI, 2011.
- Investment Management – Bhalla V. K, 17/e, S.Chand, 2011.
- Security Analysis & Portfolio Management – Fisher and Jordan, 6/e, Pearson, 2011.
- Security Analysis & Portfolio Management – Punithavathy Pandian, 2/e, Vikas, 2005.
- Investment Management – Preethi Singh, 17/e, Himalaya Publishing House 2010.

REFERENCE BOOKS:

- Fundamentals of Investment – Alexander, Sharpe, Bailey, 3/e, PHI, 2001.
- Security Analysis & Portfolio Management – Nagarajan K &Jayabal G , 1st Edition, New Age international, 2011.
- Security Analysis & Portfolio Management– Dhanesh Khatri, 1st Edition, Macmillan, 2010.
- Security Analysis & Portfolio Management– Talwar, 1st Edition, Cengage, 2016.

ADVANCED FINANCIAL MANAGEMENT

Subject Code	: 16MBA FM304	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the management of working capital.
- To understand the techniques of cash, inventory and receivables management
- To comprehend the capital structure
- To assess the dividend policy of the firm

Course Outcome:

At the end of the course, the students are able to:

- Realize the importance of management of working capital in an organization.
- Be aware of the techniques of cash, inventory and receivables management
- Get an overview of capital structure theories
- Understand and assess the dividend policy of the firm

Unit 1: (8 Hours)

Working capital management – Determination of level of current assets. Sources for financing working capital. Bank finance for working capital. (No problems on estimation of working capital). Working capital financing: Short term financing of working capital, long term financing of working capital. Working capital leverage.

Unit 2: (10 Hours)

Cash Management – Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr model, Strategies for managing surplus fund.

Unit 3: (9 Hours)

Receivables Management – Credit management through credit policy variables, marginal analysis, Credit evaluation: Numerical credit scoring and Discriminate analysis. Control of accounts receivables, Problems on credit granting decision.

Unit 4: (9 Hours)

Inventory Management: Determinations of inventory control levels : ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis.

Unit 5: (10 Hours)

Capital structure decisions – capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, Traditional approach. Arbitrage process in capital structure. Planning the capital structure: EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy

Unit 6: (10Hours)

Dividend policy – Theories of dividend policy : relevance and irrelevance dividend decision. Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. Legal and procedural aspects of dividends Corporate Dividend Tax.

(Question paper: 40% theory and 60% problems)

Practical Components:

- Study the working capital financing provided by a Bank and submit the report on the same
- Study the annual report of any two companies and prepare a cash budget for next year.
- Study dividend policy of companies and its impact on shareholders' wealth
- Study implications of bonus issues/stock splits of companies

RECOMMENDED BOOKS:

- Financial Management - M.Y. Khan & P.K. Jain, 6/e, TMH, 2011
- Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
- Financial Management - I.M. Pandey, 10/e, Vikas, 2011.
- Financial Management: Comprehensive Text Book with Case Studies – Ravi M. Kishore, 7/e, Taxmann.
- Principle of Corporate Finance– Brearly and Myers, 10/e, TMH, 2012

REFERENCE BOOKS:

- Financial Management: Theory & Practice - Brigham & Ehrhardt, 10/e, Cenage Learning, 2004.
- Corporate Finance: Ross, Westerfield & Jaffe, – TMH – 8/e, 2010
- Financial Management & Policy - Vanhorne, 12/e, Pearson
- Corporate Finance: Theory & Practice – Ashwath Damodaran, 2/e, Wiley India Pvt. Ltd., 2009.
- Cases in Financial Management - Pandey & Bhatt, 2/e, TMH, 2012.

COST MANAGEMENT

Subject Code	: 16MBA FM305	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To describe the cost concepts, cost behaviors, and cost accounting techniques that are applied to manufacturing and service businesses
- To provide an understanding of the use of cost information in support of different strategies
- To demonstrate costing methods and techniques appropriate to a variety of businesses
- To prepare and interpret budgets and operating results through variance analysis
- To describe the use of balanced scorecard and explain how the balanced scorecard supports strategic cost management

Course Outcome:

At the end of the course, the students are able to :

- Understand the cost concepts, cost behaviors, and cost accounting techniques
- Get an insight into the use of cost information in support of different strategies

- Comprehend costing methods and techniques appropriate to a variety of businesses
- prepare and interpret budgets and operating results through variance analysis

Unit 1:(10 Hours)

Introduction to Cost Management- Cost Accounting to Cost Management- Elements of costs- Classification of costs-Methods of costing-Cost Management Tools- A Strategic View to Cost Management- Preparation of a cost sheet

Unit 2:(10 Hours)

Overheads, Classification and Collection, Difference between Cost Allocation and Cost Apportionment, (Full fledged Problems on Primary and secondary distribution, Simultaneous equations, Absorption of Overhead, Theory on Under and Over absorption of Overhead)

Unit 3:(10 Hours)

Marginal Costing – Nature and Scope- Applications-Break even charts and Point, Decision Making (all types with full problems) Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing.

Unit 4:(10 Hours)

Budgetary Control:- Objectives of Budgetary control, Functional Budgets, Master Budgets, Key Factor Problems on Production Budgets and Flexible Budgets.

Standard Costing:- Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labour variances only .

Unit 5:(8 Hours)

Demerits of Traditional Costing, Activity Based Costing, Cost Drivers, Cost Analysis Under ABC (Unit level, Batch Level and Product Sustaining Activities), Benefits and weaknesses of ABC

Unit 6: (8 Hours)

Cost Audit& Reporting to Management:-objectives and advantages of Cost Audit , Cost Audit report .Management Audit- Objectives and Scope.

Reporting to Management – Purpose of reporting-Requisites of a good report,, Classifications of Report, Segment reporting, Cost Reduction and Cost Control, Target Costing – its Principles, Balanced Scorecard: Features and Purpose

(Question Paper:50% Theory and 50% Problems)

Practical components:

- Students can take up a product and get details about the actual cost of raw material, wages and other cost and prepare a cost statement. Standard cost of each component has to be obtained and the variance can be calculated to find the efficiency of Purchase, Operations and Production in charge.

RECOMMENDED BOOKS:

- Cost Accounting – Khan M. Y and Jain P. K, TMH.
- Management Accounting - Khan M. Y and Jain P. K, 6th Edition, McGraw Hill, 2012.
- A Text book of Cost and Management Accounting – Arora M. N, 11th Edition, Vikas.
- Cost Management: A strategic Approach - Vaidya S. C, Suveera Gill, Macmillan, 2010.
- Cost Accounting- Jawaharlal, & Seema Srivastava, 4th Edition, TMH.
- Accounting & Costing for Management – Sinha P. K, Excel Books, 2010.
- A Textbook of Cost Management- G.V Kesava Rao, D Gopinath, M.G. Krishnamurthy and Anita S. Yadav, Paramount Publishing House, 2013

REFERENCE BOOKS:

- Principles and Practice of Cost Accounting - Bhattacharyya, 3rd Edition, PHI.
- Managerial Accounting- James Jiambalvo, 4th Edition, Wiley India Pvt. Ltd.
- Advanced Cost Accounting – Madegowda J, HPH.
- Cost and Management Accounting – Arora M. N, 3rd Edition, HPH.
- Cost Accounting: Theory and Practice - Bhabatosh Banerjee, 13th Edition, PHI.

STRATEGIC CREDIT MANAGEMENT

Subject Code	: 16MBA FM306	IA Marks	:20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide an overview of the sound lending decisions by a bank
- To explain the process of evaluation of the loan proposal
- To provide an insight into the different types of loans
- To describe the aspects of NPA management

Course Outcome:

At the end of the course, the students are able to:

- Understand and evaluate the lending decisions by a bank
- Realize the process of evaluation of the loan proposal by banks
- Get an insight into the different types of loans
- Understand management of NPA

Unit 1:**(10 Hours)**

Credit management in banks-Screening of applications-Appraisal of credit-Sanction limit-Post sanction compliance – Monitoring supervision –Review- Government policies for credit extension- Credit institutions- Principles of good lending- Borrower study and bankers opinion-Credit policy by banks- Government regulation of credit -Prudential norms.

Unit 2: (10 Hours)

Over view of credit policy and loan characteristics-The credit process –Characteristics of different types of loans- Evaluating commercial loan requests – Financial statement analysis- Cash flow analysis- Projections-Management of the firm and other factors –Feasibility study – Fundamental credit issues - Credit analysis-Different types of borrowers – Balance sheet analysis for lending – Forms of advances secured and unsecured advances- Short term and long term advances.

Unit 3: (8 Hours)

Evaluating consumer loans – Types- Credit analysis of consumer loans- Risk–return analysis of consumer loans- Customer profitability analysis and loan pricing- Fixed Vs floating rates

Unit 4: (8 Hours)

Loan and advances against pledge- Hypothecation- Mortgage – Lien- Advances against goods- Document to title to goods – Life insurance policies – Stock exchange securities-Fixed deposit receipts –Book debts- Supply bills- Real estates – Advance against collateral securities

Unit 5: (8 Hours)

Agricultural finances and Retail lending- Crop loans- Crop insurance schemes- Dairy- Sericulture- Poultry- Animal husbandry – Horticulture – Gobar gas – Kissan credit cards – NABARD initiatives – Lead bank schemes – Retail banking advances – Concept – Retail banking products – Consumer credit financing

Unit 6: (12 Hours)

NPA management – Introduction- Identification of NPAs- Asset classification- Prudential norms- Capital adequacy – International Banking Regulation-Basel Norms – asset classification provisioning – effect of NPA on profitability - Assessment procedure- Pre-sanction appraisal – Post sanction supervision- Monitoring systems for existing and likely NPAs—Tools to manage NPAs –Compromise scheme, LokAdalats, Debt Recovery Tribunals, Corporate Debt Restructuring, Willful defaulters, SARFAESI Act, Asset Reconstruction Companies-CIBIL

Practical Components:

- Students can visit a bank and study the lending and loan appraisal system relating to Agricultural loan, consumer financing etc.
- Students can study the NPA status of leading two PSU banks and two private banks.
- Students can study and submit a report on different retail banking products

RECOMMENDED BOOKS:

- Strategic Credit Management in Banks, Popli.G.S. and Puri S. K. , PHI, 2013
- Banking Theory and Practice - Shekar and Shekar, 19th Edition, Vikas Publishing House, 2009.
- Bank Management - W. Koch Scott, Timothy, Cengage Learning, New Delhi.
- Commercial Banking -Benton Gup & James Kolari, 3rd Edition, Wiley India, 2010.
- Indian Financial System, Bharati V. Pathak, 3rd Edition, Pearson, 2012.
- Bank Credit Management, G. Vijayaragavan, Himalaya Publishing House, 2009.

REFERENCE BOOKS:

- Industrial Finance - Vishwanathan R, Macmillan, New Delhi.
- Banking and Financial System - Prasad K, Nirmala and Chandradas. Himalaya Publishing House, Mumbai.
- Managing Banking Risks - Cade, Eddic, Woodhead Publishers, England.

SEMESTER III Human Resource Management Specialisation

INDUSTRIAL RELATIONS AND LEGISLATIONS

Subject Code	: 16MBA HR301	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To enable students to understand and apply the principles of IR and develop an awareness of the significance of industrial peace.
- To provide a conceptual basis of Industrial Relations.
- To give an understanding of the components and meaning of sustaining Industrial peace anchored on harmonious Employee-Management relations.
- To discuss the various Industrial acts.

Course Outcomes:

The students should be able to

- Gain the insights of IR practices in the industry.
- Develop the knowledge related to employee-management relations
- Implementation of various industrial acts

PART A:

INDUSTRIAL RELATIONS

(32 hours)

Unit 1

(8 hours)

Introduction:

Background of Industrial Relations – Definition, scope, objectives, factors affecting IR, participants of IR, importance of IR. Approaches to Industrial relations, system of IR in India –Historical perspective & post-independence period, Code of Discipline and historical initiatives for harmonious IR, Government policies relating to labor, ILO and its influence on Legal enactments in India.

Unit 2

(8 Hours)

Collective Bargaining & Negotiation:

Collective Bargaining: Definition, Meaning, Nature, essential conditions for the success of collective bargaining, functions of collective bargaining, importance of Collective Bargaining, collective bargaining process, prerequisites for collective bargaining, implementation and administration of agreements.

Negotiations-Types of Negotiations-Problem solving attitude, Techniques of negotiation, negotiation process, essential skills for negotiation, Workers Participation in Management

Unit 3 (8 Hours)

Trade Union

Trade Unions: Meaning, trade union movement in India, Objective, role and functions of the Trade Unions in Modern Industrial Society of India, Procedure for registration of Trade Unions, Grounds for the withdrawal and cancellation of registration, union structure, Rights and responsibilities of TUs, Problems of trade unions, Employee relations in IT sector

Unit 5 (8 Hours)

Grievance procedure and Discipline management:

Grievance - Meaning and forms, sources of grievance, approaches to grievance machinery, Grievance procedures, model grievance procedure. Disciplinary procedures, approaches to manage discipline in Industry, Principles of Hot stove rule.

RECOMMENDED BOOKS:

- Employee Relations Management, P N Singh, Singh P. N., - Pearson Publications, 2011.
- Dynamics of Industrial Relations, Mamoria&Mamoria, Himalaya Publications, 2012
- Human Resource Management Principles & Practice, Aquinas, Vikas Publication.
- Personnel Management & Industrial Relations, Nair N G, Nair L, S. Chand Limited, 2001
- Essentials of Human Resource Management and Industrial Relations, Subba Rao, 3rd Revised edition, Himalaya Publishing House, 2010.

REFERENCE BOOKS:

- Industrial Relations, Trade Unions & Labour Legislation, P R N Sinha et al, Pearson Education, 2004.
- Bare Acts
 - Industrial Relations and labor laws, ArunMonappa, RanjeetNambudiri, PatturajuSelvaraj, TMH, 1997.
 - Industrial relations, trade unions and labor legislations, P R N Sinha, InduBala Sinha, Seema PriyadarshiniShekar, Pearson Education, 2013, ISBN: 9788131731642

PART B: (24 Hours)

Unit 5

INDUSTRIAL LEGISLATIONS (16 hours)

Only basic objectives and major provisions of the following legislations:

- Factories Act 1948,
- Industrial Employment (Standing orders) Act, 1946
- Employees' State Insurance (ESI) Act, 1948,
- Maternity Benefit Act, 1961
- Contract Labour Act,
- Shops and Establishments Act
- Child Labour (Prohibition & Regulation) Act, 1986
- Industrial disputes act of 1947

Unit 6 (8 Hours)

- Minimum Wages Act, 1948
- Payment of Wages Act, 1936

- Payment of Gratuity Act 1972,
- Employees' Provident Fund and Miscellaneous Provisions Act 1952;
- Payment of Bonus Act, 1965.
- Employees Compensation Act in 2013

NO PRACTICAL COMPONENT

RECOMMENDED BOOKS:

- Labor Laws for Managers, BD Singh, Excel Books, 2009
- Industrial Relations and Labor laws, SC Srivatava, 5th Edition, Vikas Publications.
- Elements of Mercantile Law - N. D Kapoor, Sultan Chand, 2004.
- Industrial Relations and Labour Legislations, Piyali Ghosh & Shefali Nandan, TMH.
- Labor Industrial Laws, Dr. V. G. Goswami, Eighth Edition, Central Law Agency, Allahabad

REFERENCE BOOKS:

- Industrial Relations, Trade Unions & Labour Legislation, P R N Sinha et al, Pearson Education, 2004.
- Bare Acts
- Industrial Relations and labor laws, Arun Monappa, Ranjeet Nambudiri, Patturaju Selvaraj, TMH, 1997.
- Industrial relations, trade unions and labor legislations, P R N Sinha, Indu Bala Sinha, Seema Priyadarshini Shekar, Pearson Education, 2013.

RECRUITMENT & SELECTION

Subject Code	: 16MBA HR302	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Course Objectives:

To understand and apply the policies and procedures of recruitment

- To provide a conceptual framework of Selection Procedure in the Industry.
- To understand the new concepts and techniques of recruitment and Selection in the Corporate.

Course Outcomes:

The students should be able to

- Learn the various recruitment policies and procedures.
- Equip with conceptual framework of selection procedures.
- Gain insights of the latest concepts and techniques used in recruitment and selection.

Unit 1:

(6 Hours)

Job Analysis: Meaning, definition and purpose. Methods of job analysis: job analysis interviews, job analysis questionnaire, task analysis inventory, position analysis questionnaire, subject expert

workshops, critical incident technique, Fleisclunann job analysis survey, functional job analysis, job element method, repertory grid, critical incident technique

Unit 2: (9 Hours)

Hiring Process & Hiring decision: Nature of hiring: regular, temporary, full time, part time, apprentice, contractual, and outsourcing, Existing post or new post to be created, Need analysis, cost analysis and job analysis.

Unit 3: (7 Hours)

Hiring internally: Meaning and definition of internal recruitment, Advantages and disadvantages in terms of cost, time, quality and suitability. Sources of internal recruitment: - circulars, intranet advertisements, employee referrals, Appointment or promotion, Policy guidelines and union settlements.

Unit 4: (10 Hours)

External Hiring: Meaning and definition of external recruitment. Sources of recruitment:- advertisement, in newspaper, TV/Radio, Internet, search on the internet, wanted signboards, consultants, employment exchange, campus recruitment, employee referrals and unsolicited applications. Advantages and disadvantages of the above sources in terms of cost, time, convenience, reach of the targeted population, and quality of applicant pool.

Job advertisement: drafting, size and contents. Contents of public sector recruitment: single or multiple sources and choosing the best source

Unit 5: (8 Hours)

Screening the candidates: Application Forms: bio-data / resume / curriculum vitae and Weighted application blanks: meaning definition, purpose, advantages and disadvantages – taking a Behavioral approach to recruitment: spotting personality patterns, making basic assumptions, Predicting the future, strategy Vs. Technique, Pinning down what is needed: targeted interviewing, focusing on behavior, assessing how person performs, assuming they have been hired. – Identifying the ingredients of success: the winning candidate's profile, challenges in the Interview, the starting point, day to day execution, dealing with people, the inner person, additional characteristics. Studying the CV.

Unit 6: (16 Hours)

Testing, Reference checking & Appointment orders: Meaning, definition, purpose, advantages and disadvantages, Ability tests clerical ability test, mechanical ability test, mental ability test, physical ability test, personality assessment test, typing test, shorthand test, computer proficiency test

Interviewing: Planning the interview, Interview process - Interview in public sector undertaking. Statutory requirements.

Reference checking: meaning, definition and purpose. Verification of character, criminal antecedents, previous work behavior and education qualifications. Verification of community certificates in public sector companies.

Appointment orders: Meaning, definition, and purpose. Contents of appointment letter, hard copy (or soft copy),

Practical Components:

- Students need to identify two jobs in the college and need to do job analysis for those positions using any of the job analysis methods.

- In teams students can be asked to give presentations about various types of jobs (regular, temporary, full time, part time, apprentice, contractual, and outsourcing) in different industries along with its advantages and disadvantages
- In Teams, select and analyze any two of the Job postings advertisements in Newspapers to know more about job description and job specification mentioned in each advertisement for every post.
- Obtain online access to the resume data base of Naukri.com or Monsterindia.com for a week give at least four Job Descriptions and specification to each student, to search and download from the data base at least five resumes for each positions.
- Students can identify 4 or 5 jobs of their interest and can create Advertisements for the same imagining that they are Proprietors of the companies and hiring for these positions.
- Debate on Advantages and disadvantages of hiring external and Internal for the selected jobs like
- Police Constable, Doctor, CEO, Mechanical Engineer, Professor etc.,
- Role play: Students can do the role play for the entire process of hiring and selecting 3 or 4 selected roles in a specific industry.

RECOMMENDED BOOKS:

- Human Resource Selection, Robert D. Gatewood and Hubert S. I, South western Cengage Learning, Mason, Ohio, 2001.
- Recruitment and Selection -Theory and Practice. Dipak kumar Bhattacharya Cengage Learning.
- Staffing Organization, Herbert G. Heneman III, Timothy A. Judge, 5thEdition, McGraw Hill International.
- Recruitment and Selection, Elearn, Revised Edition, Routledge, 2009.
- Online Recruiting and Selection: Innovations in Talent Acquisition, Douglas H. Reynolds, John A. Weiner, John Wiley & Sons, 2009.
- Effective Recruitment and Selection Practices, R. L. Compton, William J. Morrissey, Alan R. Nankervis, Bill Morrissey, CCH Australia Limited, 2009.

REFERENCE BOOKS:

- Employee Selection, Lilly M Berry, 1 edition, Cengage Learning, 2002.
- Hiring & keeping the best people, HBS Press, 2013, ISBN: 1422131785, 9781422131787
- Human Resource Planning, Dipak Kumar Bhattacharyya, 2nd edition, Excel Books, 2009, ISBN: 8174464980, 9788174464989
- High performance hiring by Robert W. Wendover, Crisp Publication, California, 1991.

COMPENSATION AND BENEFITS

Subject Code	: 16MBA HR303	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives

- To know the theoretical and practical developments in the area of compensation and benefits.
- To discuss the strategic importance of compensation for the achievement of organizational goals.

- To understand the relationship between compensation objectives and business strategy.
- To discuss the role of compensation in attracting, motivating, and retaining a high-quality workforce.

Course Outcomes:

The students will be able to

- Gain insights of various conceptual aspects of Compensation and Benefits.
- Determine the performance based compensation system for business excellence.
- Understand the Legal & Administrative Issues in Compensation Global Compensation

Unit 1: (7 Hours)

Introduction to Compensation: Definition of Compensation, Basic concepts of Compensation (wages, salary, benefits, DA, consolidated pay, Equity based programs, commission, reward, remuneration, bonus etc.), Types of Compensation Management - The Pay Model, Strategic Pay Policies, Strategic Perspectives of Pay, Strategic Pay Decisions, Best Practices vs. Best Fit Options

Unit 2: (5 Hours)

Internal Alignment: Definition of Internal Alignment, Internal Pay Structures, Strategic Choices In Internal Alignment Design, Internal Structure

Unit 3: (7Hours)

Job Evaluation: Definition of Job Evaluation, Major Decisions in Job Evaluation, Job Evaluation Methods, Final Result – Pay Structure- various methods of calculation of compensation: Straight Piece Rate Method, Flat Time Rate Method, Halsey Premium Bonus Plan, Rowan Premium Bonus Plan, Taylor Differential Piece Rate Method

Unit 4: (8Hours)

Determining External Competitiveness and Benefits Management:

Competitiveness: Definition of Competitiveness, Pay Policy Alternatives, Wage Surveys, Interpreting Survey Results, Pay Policy Line, Pay Grades

Benefits: Benefits Determination Process, Value of Benefits, Legally Required Benefits, Retirement, Medical, & Other Benefits

Unit 5: (9 Hours)

Performance Based Compensation System:

Employee Contributions: Pay For Performance (PFP): Rewarding Desired Behaviors, Designing PFP Plans, Merit Pay/Variable Pay, Individual vs. Group Incentives, Long Term Incentives. Compensation of Special Groups, Compensation Strategies for Special Groups

Unit 6: (20 Hours)

Legal & Administrative Issues in Compensation Global Compensation: Legal Issues, Pay Discrimination, Comparable Worth, Budgets and Administration: Recognizing Variations, Social Contract, Culture & Pay, Strategic Choices in Global Compensation, Comparing Systems, Expatriate Pay

Practical Components

- Students must prepare a comprehensive compensation plan to be offered to a Sales Executive, A General Manager and The CEO of an organization.

- Students to collect information from an IT organization regarding the Cost To Company of an employee.
- Students have to prepare questionnaire for conducting wage survey and carry out wage survey for any selected sector and prepare a report for the same.
- Solve various case studies.
- Students must compare and analyze compensation practices in different countries.
- Students to calculate the bonus amount eligible to an employee working as a HR Executive for the past 10 years in an automobile manufacturing organization.

RECOMMENDED BOOKS:

- Compensation & Reward Management, BD Singh, 2ndedition, Excel BOOKS, 2012.
- Compensation, Milkovich& Newman, 6thedition, Irwin/McGraw-Hill.
- Compensation and Benefit Design, Bashker D. Biswas, FT Press, 2012.
- An Introduction to Executive Compensation, Steven Balsam, Academic Press, 2002.

REFERENCE BOOKS:

- Strategic Compensation, Joseph J. Martocchio, 3rd Edition, Prentice Hall, 2004.
- Compensation Management in a Knowledge based world, Richard I. Anderson, 10th edition, Pearson Education
- Compensation Management, ErSoniShyam Singh, Excel Books.

LEARNING AND DEVELOPMENT

Subject Code	: 16MBA HR304	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To enable students to be aware of the field of learning and development and its role in optimizing performance.
- To make students understand the process of analyzing training needs and evaluating training programs
- To provide the students an overview of the various Training and Management Development Method

Course Outcomes:

The Students will be able to

- Understand the concepts of learning and development and its role.
- Learn various contemporary methods of learning and development.
- Gain insights of various training evaluation methods and career planning.

Unit 1:

(8 Hours)

Introduction to Employee learning and Development, learning, Meaning and significance, The Forces Influencing Working and Learning, classification of learning capabilities, learning theories- Reinforcement Theory, Social Learning Theory, Goal Theories, Expectancy Theory, Adult Learning Theory, pedagogy and andragogy; The basic principles of learning, The Learning Process , Mental and Physical Processes, The Learning Cycle, Instructional Emphasis for Learning Outcomes.

Unit 2: (6 Hours)

Training and Learning: Introduction, Relationship, meaning, Designing Effective Training, Forces influencing working & learning, Strategic Training, Work Environment, Characteristics influencing transfer of training, organizational environments encouraging transfer.

Unit 3: (7 Hours)

Training Needs Analysis: Meaning and significance of training needs, types of needs, components of needs, data collection, analysis and interpretation. Meaning and significance of training design and development, principles of training design, design process, identifying the training objectives, determining structure, content, duration, method, learning activities,

Unit 4: (11 Hours)

Training implementation & Methods: Meaning and significance of implementation, making or buying decision, implementation process for making and buying decisions, skills of effective trainer.

Training Methods: Presentation Methods, Hands-on Methods, Group Building Methods. Choosing Training methods. E-Learning & Use of Technology in Training: Technology's Influence on Training, Technology & Multimedia, Computer-Based Training, Developing Effective Online Learning, Blended Learning, Simulations, Mobile Technology & Training Methods, Intelligent Tutoring Systems, Distance Learning, Technologies for Training Support, Technologies for Training Administration, Learning Management Systems (LMSs), Systems for Training Delivery, Support & Administration, Choosing New Technology Training Methods.

Outward bound methods: Meaning and significance of outward bound learning (OBL) methods, process of OBL, risk, safety and ethical issues. Training aids.

Unit 5: (8 Hours)

Training Evaluation: Meaning, Reasons for Evaluating Training and significance of training evaluation, Donald Kirkpatrick's Evaluation Model, Return on investment in Training, Types of Evaluation Designs, Considerations in Choosing an Evaluation Design, data collection for training evaluation, Threats to Validity, Determining Costs, Evaluation Practices in different organizations, Measuring Human Capital and Training Activity

Unit 6: (16 Hours)

Executive Development/ Management Development/Career Management

Need, factors affecting MDP, methods, process, administration, delivery, costing & pricing, Company Strategies for Providing Development, Increased Use of New Technologies for Learning, Increased Demand for Learning for Virtual Work Arrangements, Increased Use of Training Partnerships & Outsourcing Training,

Careers and Career Management: Introduction, Importance, Career: meaning, A Model of Career Development (Career Stages), Career Management Systems

Practical Components:

- Study training programs and processes in different organizations and analyze their effectiveness.
- Students to design a training program for a specific job role.
- Students are expected to conduct a mock training session including need identification and a set of
- Students to evaluate the effectiveness of the same.
- Give a training needs analysis case and ask the students to find out the training needs
- Implement various training methods, observe and submit a report on its effectiveness.

RECOMMENDED BOOKS:

- Effective Training, P Nick and Blanchard, 2nd Edition, Pearson Education/PHI, 2005
- Training & Development, Dr. B. Janakiraman, Biztantra/Wiley Dreamtech, 2005
- Employee Training & Development, Noe A Raymond, 2nd edition, McGraw Hill Publication.
- Management Training and Development, Gupta B.L, 1st Edition, Vrinda Publications, 2011.
- Training and Development Methods, Dr. Rishipal, 1st Edition, S. Chand, 2011.
- Personal Growth and Training & Development, Ruchi Srivastava, 1st Edition, Vrinda Publications,
- 2011.

REFERENCE BOOKS:

- Training for development– Rolf Lynton & Udai Pareek, Sage Publications, 2011.
- Effective HR Training Development Strategy – Ratan Reddy, HPH, 2005.
- Training in organizations - Goldstein, 4th Edition, Cengage learning.

KNOWLEDGE MANAGEMENT

Subject Code	: 16MBA HR305	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the fundamental concepts of Knowledge management.
- To discuss the current trends in knowledge management and their manifestation in business
- To analyze and build communities of practice to contribute and share knowledge

Course Outcomes:

The students will be able to

- Gain insights about the concepts of knowledge management.
- Enable with the architecture and models of knowledge management
- Learn knowledge management lifecycle and dissemination

Unit 1:

(9 hours)

Understanding knowledge: the core of business: What Is Knowledge Management, Multidisciplinary Nature of KM, Drivers of KM, The Two Major Types of Knowledge, The Concept Analysis Technique, History of Knowledge Management, From Physical Assets to Knowledge Assets, Organizational Perspectives on Knowledge Management, Knowledge, Intelligence,

Experience, Common sense. Cognition and KM. Types of Knowledge, Knowledge Management architecture and Implementation Strategies.

Knowledge creation and capture: Knowledge Creation, Nonaka's Model, Major Theoretical KM Models, Takeuchi Knowledge Spiral Model, Knowledge Conversion.

Unit 2: (7 hours)

The knowledge management cycle: Knowledge Management System Life Cycle, Major Approaches to the KM Cycle, The Zack KM Cycle, The Bukowitz and Williams KM Cycle.

Unit 3: (6 hours)

Knowledge sharing and communities of practice: The Social Nature of Knowledge, Sharing Communities, Types of Communities, Roles and Responsibilities in CoPs, Knowledge Sharing in Virtual CoPs, Data Mining and Knowledge Discovery, Blogs, Content Management Tools, Knowledge Sharing and Dissemination Tools.

Unit 4: (12 hours)

Knowledge application: KM for Individuals, Communities and Organizations, Future Challenges for KM. Knowledge Application at the Individual, Group & Organizational Levels, Characteristics of Individual Knowledge Workers, Task Analysis and Modelling, EPSS, Knowledge Reuse, Knowledge Repositories, Strategic & Practical Implications of Knowledge Application

The role of organizational culture: Different Types of Cultures, Organizational Culture Analysis, Culture at the Foundation of KM, The Effects of Culture on Individuals, Cultural Transformation to a Knowledge-Sharing Culture, Organizational Maturity Models, KM Maturity Models, CoP Maturity Models,

Unit 5: (12 hours)

KM strategy and metrics: Knowledge Management Strategy, Knowledge Audit, Gap Analysis, The KM Strategy Road Map, The Management of Organizational Memory, Balancing Innovation and Organizational Structure, Historical Overview of Metrics in KM, KM Metrics, The Benchmarking Method, The Balanced Scorecard Method.

Unit 6: (10 hours)

The KM team & learning organizations: learning organization: The mystique of learning organization, learning and change, RICE Model. Major Categories of KM Roles, Senior Management Roles, KM Roles and Responsibilities within Organizations, the KM Profession. Ethical, legal and managerial issues.

Practical Components:

- To expose and make students to prepare a report on knowledge management practices implemented by successful companies.
- Make a team of 2-3 students and asking them to conduct a telephonic interview or survey regarding local businesses familiarity with and level of literacy in KM.
- To do a comparison on the KM Life Cycle Models and seeing their applicability in organizations.
- To organize a group discussion for students and enable them to go through the knowledge acquisition phases.

- Asking students to compare and contrast on different COPs.

RECOMMENDED BOOKS:

- Knowledge Management, Elias M Awad, Hassan M Ghaziri, PHI, 3rd Edition.
- Knowledge Management in Theory and Practice, KimizDalkir, 2nd Edition, PHI.
- Knowledge Management: Tool for Business Development, Dr. B. Rathan Reddy, Himalaya Publishing House.
- Knowledge Management, Sudhir Warier, Vikas Publishing House.

REFERENCE BOOKS:

- Knowledge Management, RatnajaGogula, ICFAI University Press, 2002.
- Handbook on knowledge management, Holsapple, Springer Verlag, 2003.
- Knowledge Management: Systems and Processes, Fernandez Irma Becerra, Sabherwal Rajiv, Prentice Hall India.

CONFLICT AND NEGOTIATION MANAGEMENT

Subject Code	: 16MBA HR306	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the nature of various dimensions of conflict
- To learn various strategies and techniques to manage conflicts
- To understand the importance and role of negotiation in conflict resolution
- To understand the importance of cross-cultural and gender dimensions of negotiation

Course Outcomes:

The students will be able to

- Gain insights of various dimensions of conflicts in an organization
- Know the various strategies and techniques of managing conflicts.
- Learn the process of negotiation and its relevance in conflict resolution.

Unit 1:

(8 Hours)

Introduction: Understanding conflict, components, perspectives of conflict, types of conflict, models of conflict – Process and Structural Models, functional & dysfunctional conflict, relationship between conflict and performance in team, levels of conflict – intrapersonal, interpersonal, group &

organizational conflicts, sources of conflict - intrapersonal, interpersonal, group & organizational sources.

Unit2: (8 Hours)

Conflict Management Design: Nature of conflict Management, contingency approach, conflict management process, the conflict domain, conflict trends, conflict distribution, conflict mapping and tracking.

Unit 3: (10Hours)

Managing Conflict: Managing interpersonal conflict: Thomas conflict resolution approach, behavioral style and conflict handling, the CosierSchank model of conflict resolution, collaboration & conflict resolution, dealing with difficult subordinates, boss & colleagues, 1 to 1 dispute resolution.

Managing team & organization conflict: techniques to resolve team conflict, strategies to resolve organizational conflict, effective listening and dialogue skills, humor and conflict resolution, negotiation as a tool for conflict resolution.

Unit 4: (8 Hours)

Conflict resolution and Cost: Conflict resolution models, framework model, classical ideas, new developments in conflict resolution. Environmental conflict resolution, gender and conflict resolution. Assessing the cost of workplace conflict.

Unit 5: (14 Hours)

Negotiations/Negotiation strategies -Types of Negotiations, negotiation process, factors for successful negotiations, essential skills for negotiation, tricks used in negotiation process, psychological advantage of negotiations, Techniques of negotiation, issues in negotiations.

Negotiation strategies: Strategy and tactics for distributive bargaining, strategy and tactics for integrative negotiation, negotiation strategy and planning. Finding and using negotiation power, sources of power, Ethics in negotiation.

Unit 6: (8Hours)

Managing difficult negotiations: Third party approaches: Third party interventions, formal intervention methods – Arbitration, Mediation and Process Consultation, Informal intervention methods, best practices in negotiation.

Practical Components

- Survey the conflict resolution techniques adopted by individuals based on individual personality types.
- Dividing students into groups and give a scenario to negotiate and reach conclusion.
- Reading: 8 Habits of Highly Effective People; apply the concepts to understand how people approach negotiation through different mind – sets.
- Conduct Role Plays for different scenarios.
- Solve various case studies dealing with conflict between teams and organizations.

- Ask students to identify three unconscious factors that may affect their negotiation effectiveness and ask them to explain why or how that phenomenon may occur.
- Management games like two dollar game, cross the line games can be played in the class to develop negotiation skills among the students.

RECOMMENDED BOOKS:

- Corporate Conflict Management - Concepts and Skills, Eirene Leela Rout, Nelson Omiko, Prentice India, 2007.
- Negotiations, Roy J. Lewicki, David M. Saunders, Bruce Barry, 5/e, Mc Graw Hill, 2005
- Contemporary Conflict Resolution, Oliver Ramsbotham, Hugh Miall, Tom Woodhouse, 3rd edition, Polity publishers, 2011.
- Handling Conflict and Negotiation, Manchester Open Learning, illustrated edition, Kogan Page, 1993.

REFERENCE BOOKS:

- Managing conflict and negotiation, B.D. Singh, 1st edition, Excel books, 2008.
- Conflict Management: Practical guide to develop negotiation strategies, Barbara A Budjac Corvette, Pearson Prentice Hall, 2006.
- Managing Conflict in Organizations, M. Afzalur Rahim, 4th Edition, Transaction Publishers, 2011.

**SEMESTER IV
MARKETING SPECIALISATION
SALES MANAGEMENT**

Subject Code	: 16MBA MM401	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To provide an understanding of the concepts, techniques and approaches in Sales Management.
- To emphasize on the Sales Manager's problems and dilemmas.
- To develop skills for generating, evaluating and selecting sales strategies.

Outcomes:

The student should be able to:

- Know the distinction between the skills required for selling and sales management.
- Develop a plan for organizing, staffing and training the sales force.
- Organize sales territories to maximize selling effectiveness.

- Evaluate sales management strategies

Unit 1: (8 hours)

Introduction to sales management: Meaning, Evaluation, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. Types of sales organizations.

Unit 2: (8 hours)

Selling skills & Selling strategies: Selling and business Styles, selling skills, situations, selling process, sales presentation, Handling customer objections, Follow-up action.

Unit 3: (8 hours)

Management of Sales Territory & Sales Quota: Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting quota. Recruitment and selection of sales force, Training of sales force.

Unit 4: (10 hours)

Sales force motivation and compensation: Nature of motivation, Importance, Process and factors in the motivation, Compensation-Meaning, Types of compensation plans and evaluation of sales force by performance and appraisal process. **Sales management job:** Standard sales management process-international sales management -international market selection-market survey approach or strategy

Unit 5: (8 hours)

Sales Manager and Sales Person: Role of sales manager and sales people; functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people-Time management for sales manager and sales person.

Unit 6 (8 hours)

Selling on the internet: Selling agents for internet trading-net selling, advertising in net trading, payment system in internet trading-smart card, credit card, debit card- payment by card: advantages and disadvantages; How to make internet selling safe-Digital signature, biometric method and legal or regulatory environment; Growth of internet trading in India.

Case Studies in Sales Management (6 hours)

Practical component:

- Interview a salesperson and write a brief report about what they like and dislike about their jobs, their salary, travelling allowances, sales quotas, why chose sales career, and what does it take to succeed in this profession
- Ask your friends if they would buy certain goods like groceries, vegetables, socks, mobile, pens etc from the roadside vendor as against a regular shop. Group the products

into low risk and high risk ones. Does this buying behaviour also depend on the personality of the individual doing the buying? Or the one doing the selling?

- Students can make a presentation on any product or the services of student choice, covering selling strategies and one day work exposure towards merchandising in any big retail outlets of respective places where the institute is operating. Rural colleges can send the students to the city nearby to observe the merchandising planning in retail outlets and to make a small report.
- Roles and functions of sales manager and sales people are different in every organization. Sales people view the roles of sales managers in their own way and vice versa. You are the sales manager of a company. You make an analysis of what you feel should be roles of a sales manager and a salesperson for maximizing sales of the organization.
- Your company is active in internet trading. A current issue in internet trading is : how to make internet selling safe. Different methods have been suggested for safety or security of internet trading. You have to analyze different methods and recommend a method for your company.

RECOMMENDED BOOKS:

- Sales Management by Charles, Futrell, 6/e, Thomson South Western, 2003.
- Sales & Distribution Management, Tapan K. Panda & Sunil Sahadev, 6/e, Oxford University Press.
- Sales & Distribution Management, A. Nag, McGraw Hill, 2013

REFERENCE BOOKS:

- Managing of Sales Force by Spiro Stanton Rich, 11/e, TMH, 2003.
- Sales & Retail Management, an Indian perspective by Dr. S.L. Gupta, 1/e, Excel Books, 2007.
- Salesmanship and Sales Management-P.K. Sahu & K. C. Raut, 3/e, Vikas Publishing House.
- Sales Management-Douglas J Dalrymple, William L Crowe-John Wiley & Co.
- Sales & Distribution Management- Text and Cases, 2nd Ed, McGraw Hill.

INTEGRATED MARKETING COMMUNICATIONS

Subject Code	: 16MBA MM402	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours	: 03
Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives:

- To build a comprehensive framework for integrated marketing communications.
- To study the advertising, publicity, personal selling, direct marketing and sales promotion.
- To enhance knowledge of emerging trends in integrated marketing communications.

Outcomes:

The student should be able to:

- Define and apply knowledge of various aspects of managerial decision making related to marketing communications strategy and tactics.
- Ability to create an integrated marketing communications plan which includes promotional strategies.
- Explain the role of IMC in the overall marketing & Use effectiveness measures to evaluate IMC strategies

Unit 1:

(10 Hours)

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model. Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications Purpose, Role, Functions, Types, Advertising Vs Marketing mix, Advertising appeal in various stages of PLC

Unit 2:

(8 Hours)

Advertising Agency: Type of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation.

Advertising objectives and Budgeting: Goal setting – DAGMAR approach, various budgeting methods used.

Unit 3:

(8 Hours)

Media planning: Developing Media plan, Problems encountered, Media Evaluation- Print, Broadcast media, Support media in advertising.

Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy.

Unit 4:

(8 Hours)

Direct Marketing: Features, Functions, Growth, Advantages/Disadvantages, And Direct Marketing Strategies.

Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push/pull strategies, Co-operative advertising, Integration with advertising and publicity

Public relation/ Publicity:- Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR Vs Publicity.

Unit 5:

(8 Hours)

Monitoring, Evaluation and control: Measurement in advertising, various methods used for evaluation, Pre-testing, Post testing.

Unit 6:

(10 Hours)

International Advertising: Global environment in advertising, Decision areas in international advertising

Internet advertising: Meaning, Components, Advantages and Limitations, Types of Internet advertising

Industrial advertising: B 2 B Communication, Special issues in Industrial selling.

Case studies in Indian context only

(4 Hours)

Practical Components:

- Study the IMC programs adopted by various colleges to students applying for an MBA course? Is the tactic adopted by your college right? If no, what are your suggestions?
- Study the role of newspapers, radio, television, billboards, internet and other media in the marketing of mobiles, cold drinks, jeans, mobiles etc.
- Observe a marriage in your family and write about how you would 'event manage' it?
- Take an advertisement introducing a new product like soap, biscuit etc and find the media in which it was advertised. Ask your friends if they can recall this advertisement and the message. Analyse if they would or would not buy the product on the basis of this advertisement? And why?
- Students can do a survey on effective media communications.

RECOMMENDED BOOKS:

- Advertising and Promotions IMC Perspectives: Belch and Belch, 9/e, Tata McGraw Hill, 2012.
- Advertising & Integrated Brand Promotion - O'Guinn, Allen, Semenik, Cengage Learning.
- Integrated Advertising, Promotion, and Marketing Communications, Clow, Baack, 3/e, Pearson Education, 2007.
- Integrated Marketing Communications – Niraj Kumar, HPH.

REFERENCE BOOKS:

- Foundations of Advertising, Chynawalla & Sethia, HPH, 2007
- Advertising management - Rajeev Batra, John G Myers & Aaker, 5/e, PHI, 2007.
- Event marketing and management- Sanjaya Singh, Vikas Publication, 2003.
- Advertising Basics, Vilanilam, Varghese, Response BOOKS, 2007
- Advertising, Sangeeta Sharma & Raghuvir Singh, PHI, 2006.

E-MARKETING

Subject Code	: 16MBA MM403	IA Marks : 20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Objectives:

- To understand the important concepts related to e-marketing
- To learn the use of different electronic media for designing marketing activities.
- To acquaint the students with the latest techniques of e-marketing.

Objectives:

The student should be able to:

- Recognize appropriate e-marketing objectives.
- Appreciate the e-commerce framework and technology.
- Illustrate the use of search engine marketing, online advertising and marketing strategies.

Unit 1: (10 Hours)

Introduction to E-Marketing: Landscape – Past – Today – Future – Internet Marketing Paradigm – Internet Infrastructure Stack

Business Models & Strategies: Strategic Planning – Strategy to Electronic Planning – Strategic Drivers of the Internet Economy – Business Models to E-Business Models – E-Business Models – Performance Metrics – The Balanced Scorecard

Unit 2: (12 Hours)

E-Marketing Plan: Overview of the E-Marketing Planning Process – Creating an E-Marketing Plan – A Seven-Step E-Marketing Plan

The E-Marketing Environment: Overview of Global E-Marketing Issues – Country and Market Opportunity Analysis – Technological Readiness Influences Marketing – Wireless Internet Access – The Digital Divide Ethical and Legal Issues – Privacy – Digital Property – Online Expression – Cyber Security – Cyber Crime

Unit 3: (8 Hours)

E-Marketing Research: Data Drive Strategy – Marketing Knowledge Management – Monitoring Social Media – Technology-Enabled Approaches – Real-Space Approaches – Marketing Databases and Data Warehouses – Data Analysis and Distribution – Knowledge Management Metrics – Consumer Behaviour Online – Segmentation – Targeting – Differentiation – Positioning Strategies

Unit 4: (10 Hours)

E-Marketing Management: Product – Products on Internet – Creating Customer Value Online – Product Benefits – E-Marketing Enhanced Product Development – Price – Change in Pricing Strategies – Buyer and Seller Perspectives – Payment Options – Pricing Strategies – Distribution – Online Channel Intermediaries – Distribution Channel Length and Functions – Channel Management and Power – Distribution Channel Metrics – Promotion – Integrated Marketing Communication (IMC) – Internet Advertising – Marketing Public Relations – Sales Promotion Offers – Direct Marketing – Personal Selling – IMC Metrics

Unit 5: (8 Hours)

Customer Acquisition and Retention: Profile of Consumers – Browsing Behaviour Model – Elements of Social Media – Social Media Strategies – Social Media Performance Metrics – Building Customer Relationships – Relationship Marketing – Stakeholders – Three Pillars of Relationship Marketing – Customer Relationship Management (CRM) – CRM Building Blocks – Ten rules for CRM Success

Unit 6: (8 Hours)

Evaluating Performance and Opportunities: Measuring and evaluating web marketing programs – Social and Regulatory Issues – Privacy – Security – Intellectual Property – Mobile Marketing – Media Coverage

Emerging Issues: Online Governance and ICANN – Jurisdiction – Fraud – Consumer Loyalty of Website-Services – The Quadratic Effect of Flow – Role of Technology Readiness in Developing Trust and Loyalty for E-Services in Developing Countries

Practical Component:

- Students can form a team and identify Internet Properties & its Marketing Implication
- Students can choose a Website for analysis based on its content, design, usability, attractiveness and other website properties
- Students can conduct a survey on Consumer who use internet marketing to identify the pros and cons of e-marketing.
- Students can do a project on branding strategies using internet marketing.
- Students can write a report on Google advertising strategies
- Students can discuss about traditional offline business in the online world.

RECOMMENDED BOOKS:

- E-Marketing, Judy Strauss and Raymond Frost, Prentice Hall, 6th Edition, 2013
- Internet Marketing: Integrating Online and Offline Strategies. M. L. Roberts and Debra Zahay, 3rd edition, Cengage Publishing, 2013
- Digital Marketing: Strategy, Implementation and Practice, Chaffey D., Ellis-Chadwick, 5th Edition, F., Pearson, 2012.
- E Marketing – The essential guide to online marketing, Rob Stokes, Flat worldknowledge, 2010.
- E-marketing in Developed and Developing Countries: Emerging Practices, Hatem El-Gohary and Riyadh Eid, IGI Global, 2013

REFERENCE BOOKS:

- The Essential Guide to Online Marketing, Rob Stokes, Quirk, ISBN: 9781936126323
- The New Rules of Marketing and PR: How to Use Social Media, Blogs, News Releases, Online Video, and Viral Marketing to Reach Buyers Directly, David Meerman Scott, 2nd Edition, Jan 2010
- E-Commerce: An Indian Perspective, P. T. Joseph, Prentice Hall, 4th Edition, 2013
- Electronic Commerce: A Simplified Approach, Munesh Chandra Trivedi, Jaico Publishing House, 2011.
- Online Display Advertising: Targeting and Obtrusiveness, Marketing Science, Goldfarband Tucker, May-June 2011.

STRATEGIC BRAND MANAGEMENT

Subject Code	: 16MBA MM404	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To appreciate the relationship between corporate strategy and Brand Management.

- To explore the various issues related to Brand Management, brand association, brand identity, brand architecture, leveraging brand assets, brand portfolio management.
- To develop familiarity and competence with the strategies and tactics involved in building, leveraging and defending strong brands in different sectors.

Outcomes:

The student should be able to:

- Develop skills for managing brands strategically.
- Compare and contrast the elements of product and brand management.
- Assess growth-opportunities for brands, e.g., brand extension strategies
- Critique the different measures of brand equity.

Unit 1: (8 Hours)

Introduction to the concept of Brand Management:

Brand –Meaning, Definition, Evolution of Brands, Functions of Brand to consumer, Role of Brand- Advantages of Brand, Product Vs Brand,

Branding- Meaning, Creation of Brands through goods, services, people, Organisation, Retail stores, places, online, entertainment, ideas, challenges to Brand builders

Brand Management-Meaning & Definition.

Strategic Brand Management Process-Meaning, Steps in Brand Management Process Strong Indian Brands

Unit 2: (8 Hours)

Customer Based Brand Equity:

Customer Based Brand Equity-Meaning, Model of CBBE

Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks- Resonance, Judgments, Feelings, performance, imagery, salience-Brand Building Implications, David Aaker's Brand Equity Model.

Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism,

Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines

Brand Value: Definition, Core Brand values, Brand mantras, Internal branding,

Unit 3: (10 Hours)

Choosing Brand Elements to Build Brand Equity:

Criteria for choosing brand elements, options & tactics for brand elements-Brand name, Naming guidelines, Naming procedure, Awareness, Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging.

Leveraging Brand Knowledge:

Meaning of Brand Knowledge, Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process.

Unit 4: (10 Hours)

Brand Value chain- Designing Brand Tracking studies, Establishing brand Equity Management Systems.

Methods for measuring Brand Equity- Quantitative Techniques & Quantitative Techniques, Comparative methods-Brand based comparisons, marketing based comparisons-Conjoint Analysis, Holistic methods.

Managing Brand Equity: Brand Reinforcement, Brand Revitalization, Brand Crisis.

Unit 5: (8 Hours)

Designing and sustaining branding strategies: Brand hierarchy, Branding strategy, Brand extension and brand transfer, Managing Brands overtime. Brand Architecture and brand consolidation.

Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.

Unit 6: (8 Hours)

Making Brands go Global: Geographic extension, sources of opportunities for global brand, single name to global brand, consumers & globalization, conditions favoring marketing, barriers to globalization, managerial blockages, organization for a global brand, pathways to globalization.

Luxury Brand Management:

Luxury definition and relativity, luxury goods and luxury brands, basic psychological phenomena associated with luxury purchase, luxury marketing mix, luxury retail, International luxury markets: historical leaders and emerging countries.

Case studies (4 Hours)

Practical Components:

- Go to a supermarket and find the brand elements in various brands of soaps, mobiles, jeans, and other product
- If you would start an MBA College, what would the positioning be with POP's and POD's?
- Pick up your college, analyse its positioning and how would you reposition it?
- Pick a multiproduct company and as completely as possible analyze its brand portfolio and brand extensions?
- Consider some groups like Tata's, Birla's, Infosys etc – what is their branding strategy
- Students are supposed to assess the product life cycle and appraise alternative approaches to luxury brand management.
- Students can select any two popular brands and identify and examine the criteria for success in the luxury brand industry.

RECOMMENDED BOOKS:

- Strategic Brand Management, Building Measuring & Managing Brand Equity – 2nd Ed Phi / Pearson Education – Kevin Lane Keller.
- Brand Management -The Indian Context – Y L R Moorthi – Vikas Publication.
- Strategic Brand Management – Jean, Noel, Kapferer – Kogan Page India.
- Brand Imitations – Dr S Kaplan, Dr S Pandey, 1/e, HPH, 2004.
- Brand Management, Tapan Panda, 2/e, Excel Publication.

REFERENCE BOOKS:

- Brand Management- Harish V Verma, 2/e, Excel BOOKS.
- Compendium Brand Management – Chunnawalla, 1/e, HPH, 2003.
- Managing Indian Brands – S Ramesh Kumar – Vikas.
- Strategic Brand Management- Richard Elliott & Larry Perclu, 1/e, Oxford Press.
- Creating powerful brands – Chernatony, 1/e, Elsevier Publication.

RURAL MARKETING

Subject Code	: 16MBA MM405	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To provide a conceptual understanding on the RuralMarketing with special reference to Indian context.
- To create awareness about the applicability of the concepts, techniques and processes ofmarketing in rural context.
- To familiarize with the special problems related to sales in rural markets.

Outcomes:**The student should be able to:**

- Highlight the characteristics of Indian rural markets and describe the differences between rural and the urban economy
- Analyze the roadblocks of Indian rural market and advocate solutions for the problems of rural markets.
- Emphasize the different strategies adopted by Indian companies for rural markets.
- Apply the strategies to be adopted for influencing the rural consumers.

Unit 1:**(8 Hours)**

Introduction to Indian Rural Marketing: Definition, scope of rural marketing, concepts, classification of rural markets, rural vs. urban markets. Rural marketing environment: Population, occupation pattern, income generation, location of rural population, expenditure pattern, literacy level, land distribution, land use pattern, irrigation, development programs, infrastructure facilities, rural credit institutions, rural retail outlets, print media in rural areas,rural areas requirement, rural demand and rural market index, problems in rural marketing.

Unit 2:**(8 Hours)**

Rural Consumer behaviour: Consumer buying behaviour models, Factors affecting ConsumerBehaviour, Social factors, Technological Factors, Economic Factors, Political Factors,Characteristics of Rural consumer- Age and Stages of the Life cycle, Occupation and Income, Economic circumstances, Lifestyle, Personality and Brand Belief, Information Search and prepurchase Evaluation, Rise of Consumerism, Consumer Buying Process, Opinion LeadershipProcess, Diffusion of Innovation, Brand Loyalty.

Researching Rural Market: Sensitizing rural market, Research design- reference frame, Research approach, Diffusion of innovation, Development studies, PRA approach, The need for PRA, Sampling, Operational aspects of data collection,

Unit 3: (8 Hours)

Rural Marketing of FMCG's: Indian FMCG industry, characteristics of Indian FMCG sector, Challenges in the FMCG industry, Rural Marketing of FMCG's: Select case studies

Rural Marketing of Consumer durables: Issues related to consumer durables in the rural market, Rural Marketing of Consumer durables: Select case studies

Rural marketing of financial services: Marketing objectives and approaches, Evolution of rural banking after independence, Challenges in marketing for banking services in rural, opportunities for banking in rural areas, marketing strategies for banking services

Unit 4: (10 Hours)

Marketing of agricultural inputs: Indian tractor industry: A brief overview, Challenges for Indian tractor industry, factors suggesting better future prospects for tractor industry, marketing strategies for tractor industry

Fertilizer industry in India: Marketing of fertilizer industry, classification of fertilizer industry, Challenges for marketing of fertilizer industry, marketing strategies for fertilizer industry.

Indian agrochemical market: Marketing environment for agrochemicals in India, factors affecting agro chemicals market growth, structural challenges faced by Indian agrochemical industry, marketing strategies for agro chemicals.

Unit 5: (8 Hours)

Marketing of agricultural produce: Profiling of Indian agricultural produces marketing, challenges in marketing of agricultural produce, Strategies to promote marketing of agricultural produce

Marketing of rural artisan products, Characteristics of Indian handicrafts industry, Challenges for rural artisan sector, Government policy towards handicrafts sector, marketing strategies for the development of rural artisan sector

Corporate sector in agri-business: Reasons for increased interest of corporate sector in agribusiness, opportunities, in the agri-business, benefits of corporate driven agri-business system involvement of corporate sector in agri-business

Unit 6: (14 Hours)

Distribution Strategy: Introduction Accessing Rural Markets, Coverage Status in Rural Markets, Channels of Distribution, Evolution of Rural Distribution Systems- Wholesaling, Rural Retail System, Vans, Rural Mobile Traders: The last Mile Distribution, Haats/Shandies, Public Distribution System, Co-operative Societies Behaviour of the Channel, Prevalent Rural Distribution Models- Distribution Models of FMCG Companies, Distribution Model of Durable Companies, Distribution of fake products, Emerging Distribution Models- Corporate –SHG Linkage, Satellite Distribution, Syndicated Distribution, ITC's Distribution Model, Petrol pumps and Extension counters, Barefoot agents, Agricultural agents, Agricultural input dealers, Other channels, Ideal distribution model for Rural

Digitalizing the Indian rural markets-e-rural marketing: select live case studies-ITC e-choupal, TARA haat, EID Parry's Indiaagriline, Kandhamal Apex Spices Association for Marketing(KASAM)

Communication strategy: Challenges in Rural Communication, A view of Communication Process, Developing Effective- Profiling the Target Audience, Determining communication objectives, designing the message, selecting the communication channels, deciding the promotion mix, Creating advertisement for rural audiences rural media- Mass media, Non-Conventional Media, Personalized media, Rural Media: The importance of the two-step flow of communication Media Typology, The Media Model, Media innovation, Influence of Consumer Behaviour on Communication strategies

Practical Components:

- Visit to the various Micro Finance Institutes, who extend their services in catering rural market.
- Visit to a village and understand the market structure and also understand the functioning part of the rural markets
- Students should come up with new product designing with the rural marketing mix 4 As (Awareness, Acceptability, Adaptability and Affordability)
- Students can do a survey on corporate farming and its effect on income of the rural farmer.

RECOMMENDED BOOKS:

- Rural Marketing - Pradeep Kashyap & Siddhartha Raut, Biztantra.
- Rural Marketing - Gopal Swamy T. P, 3/e, Vikas Publishing House.
- Rural Marketing - Dogra & Karminder Ghuman, 1/e, TMH.
- Rural Marketing - Sanal Kumar Velayudhan, 2/e, Response Publication, 2007.

REFERENCE BOOKS:

- Rural Marketing – Krishnamacharyulu C. G & Lalitha Ramakrishnan, Pearson Education.
- Rural Marketing – Habeeb Ur Rahman, 1/e, HPH, 2004.
- Rural Marketing – Minoti Kamat & R. Krishnamoorthy, 3/e, HPH.
- Agricultural Marketing In India – Acharya, Oxford I B H.
- Advertising & Marketing in Rural India- Tej K. Bhatia, 2/e, Macmillan.
- Marketing of Agricultural Products - Richard Kohls and Joseph N. Uhl, 9/e, PHI.

INTERNATIONAL MARKETING MANAGEMENT

Subject Code	: 16MBA MM406	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Hours:	03
Number of Lecture Hours	: 56	Exam Marks:	80
Practical Component	: 02 Hours/ Week		

Objectives:

- To introduce students to the international marketing management process, design and theories
- To develop skills relating to international trade.
- To familiarize the steps involved in import export documentation.

Outcomes

The student should be able to:

- Be aware of the differences between domestic marketing and international marketing.
- Draft international marketing Strategies
- Note down the import export documentation.

Unit 1:

(8 hours)

International Marketing – Definition and Scope – Reasons and Motivations – Global Vs Domestic Marketing – Concepts related to the management of international marketing function – World Trade and India's foreign trade: an overview – Institutional framework for exports in India.

Unit 2:

(8 hours)

International Trade Theories- Absolute cost-comparative Cost- H-O Theorem- New Trade Theories- Porter's Diamond Theory- Managerial Implications
Global marketing environment – cultural Environment Political and Legal Environment Economic Environment.- Modes of entry in to foreign business

Unit 3:

(10 hours)

India's Export – Import policy – procedure and Documentation - INCO terms - balance of trade and payments

Unit 4:

(12 hours)

International Product Policy and Planning – Need for product planning, Product adaptation, Product Standardization, Cross country segmentation, Product life cycle in International Marketing, International Packaging,
International Market selection – International Marketing Research – International marketing Planning and control.

Unit 5:

(9 hours)

International Pricing and Promotion decisions- International pricing decisions-International promotional decisions-Evaluation of international marketing performance- coordination of international marketing performance

Unit 6:

(9 hours)

International distribution strategy: International Channels – Channel alternatives – Importance of Channel decision – Factors influencing the Channel decision – Channel Selection decision – International Retailing – Role of Logistics

Practical Component:

- Select the best method of entry for doing business in this country and decide on the relevant market segments to target in the selected country and overall marketing approach.
- Review detailed guidelines for developing an international marketing plan

- Analyse international marketing environment to understand opportunities and threats that a company underlying the behaviors of international consumers and business associates.
- Conduct international marketing research to generate information on consumers, competitors and other aspects of the international marketing environment.
- Select countries for international expansion and an appropriate method of entry for international markets ranging from indirect export to joint venture to foreign direct investment.
- Market segmentation, targeting, and positioning strategy for international markets

RECOMMENDED BOOKS:

- International marketing Management – An Indian Perspective, Varshney and Bhattacharya, Sultan Chand & Sons, New Delhi.
- Global Marketing Management, Keegan, Prentice Hall of India, New Delhi.
- International Marketing, Philip Cateora and John Graham, TataMcGraw Hill, New Delhi.
- Export Management, D.C.Kapoor, Vikas Publishing House, New Delhi.

REFERENCE BOOKS:

- Essentials of International Marketing, Donald L. Brady, 1st Edition, JaicoPublishingHouse, 2011
- Export: What, Where, How, Para Ram, Anupam Publishers, Delhi.

SEMESTER IV Finance Specialisation

MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING

Subject Code	: 16 MBA FM401	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To facilitate understanding of corporate merger and acquisition activity and restructuring
- To communicate to the students the role that M&A plays in the contemporary corporate world.
- To understand how to use M & A as a strategic tool.
- To compare and contrast the various forms of corporate restructuring.
- To assess human and cultural aspects of M&A's.

Course Outcome:

At the end of the course, the students are able to:

- Understand corporate merger and acquisition activity
- Analyze the mergers & acquisition deals that have taken place in the recent past.
- Understand synergies of mergers & acquisition deals.
- Compute the valuation associated with M&A.
- Understand the human and cultural aspects of M&A's

Unit 1: (9 Hours)

Mergers- types of merger– theories of mergers- operating, financial and managerial synergy of mergers – value creation in horizontal, vertical and conglomerate mergers – internal and external change forces contributing to M & A activities- Impact of M & A on stakeholders.

Unit 2: (7 Hours)

M & A – A strategic perspective- industry life cycle and product life cycle analysis in M&A decision, strategic approaches to M&A- SWOT analysis, BCG matrix.

Unit 3: (10 Hours)

Corporate restructuring – significance - forms of restructuring – joint ventures – sell off and spin off – divestitures – equity carve out – leveraged buy outs (LBO) – management buy outs – master limited partnership– Limited Liability Partnership (LLP) in India: Nature and 91 incorporation of LLP-De merger- strategic alliance- buyback of shares.

Unit 4: (8 Hours)

Merger Process: Dynamics of M&A process - identification of targets – negotiation - closing the deal. Five-stage model – Due diligence– Types - due diligence strategy and process - due diligence challenges. Process of merger integration – organizational and human aspects – managerial challenges of M & A.

Unit 5: (12 Hours)

Methods of financing mergers – cash offer, share exchange ratio – mergers as a capital budgeting decision Synergies from M&A: Operating and Financial synergy Accounting for amalgamation – amalgamation in the nature of merger and amalgamation in the nature of purchase- pooling of interest method, purchase method – procedure laid down under Indian companies act of 1956

Unit 6: (10 Hours)

Takeovers, types, takeover strategies, - Takeover defences – financial defensive measures – methods of resistance – anti-takeover amendments – poison pills
Legal aspects of Mergers/amalgamations and acquisitions/takeovers- Combination and Competition Act- Competition Commission of India (CCI), The SEBI Substantial Acquisition of Shares and Takeover code

Practical component:

- Pick up any latest M&A deal.
- Generate the details of the deal and then study the deal in the light of the following.
- Nature of the deal: merger, acquisition, or takeover. If it is a merger, what type of merger is it?
- Synergies likely to emerge to the combining and the combined firm(s) from the deal
- The valuation for the merger
- The basis for exchange rate determination

RECOMMENDED BOOKS:

- Mergers, Restructuring And Corporate Control, Fred Weston, Kwang S Chung, Susan E Hoag, 4/e, Pearson Education.
- Corporate Finance-Theory And Practice – AswathDamodaran – John Wiley & Sons.

- Takeovers, Restructuring And Corporate Governance, Weston, Mitchell And Mulherin - 4/e, Pearson Education, 2003.
- Mergers, Ramanujam et al, TMH, 2003.
- Advanced Accounts Vol. 2 – Shukla & Grewal, S.Chand& Sons.
- Mergers and Acquisitions, Rajinder S. Aurora, Kavita Shetty and Sharad R. Kale, Oxford University Press, 2011.

REFERENCE BOOKS:

- Value Creation from Mergers And Acquisitions, SudiSudarsanam – 1/e, Pearson Education, 2003.
- Merger Acquisitions & Corporate Restructuring – Chandrashekar Krishna Murthy & Vishwanath. S.R – Sage Publication.
- Mergers, acquisitions and Corporate Restructuring, NishikantJha, Himalaya Publishing House, 2011.
- Corporate Restructuring, Bhagaban Das, DebdasRaskhit and SathyaSwaroopDebasish, Himalaya Publishing, 2009.
- Business Legislation for Management, M.C. Kuchhal and VivekKuchhal, 4/e, Vikas Publishing House, 2013.

RISK MANAGEMENT AND INSURANCE

Subject Code	: 16MBA FM402	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To provide an understanding of different types of risk.
- To provide an understanding of the risk identification and measurement
- To give an overview of role of Insurance in risk management.
- To comprehend insurance contracts such as Life Insurance, general insurance and marine insurance.
- To provide an understanding of the management of insurance companies

Course Outcome:

At the end of the course, the students are able to:

- Understand the process of identifying the risk.
- Recognize the complexities involved in risk identification and measurement
- Be acquainted with the function of Insurance in risk management.
- Be aware of various types of insurance contracts.
- Understand working of insurance companies.
-

Unit 1:

(10 Hours)

Introduction to Risk Management and Risk Identification: Risk-Risk and Uncertainty-Types of Risk-Burden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk

Risk Management-Risk Management Process-Identification Loss exposures-Analyzing Loss exposures-Objectives of Risk Management-Select the Appropriate Risk Management Technique-Implement and Monitor the Risk Management Program-Risk Management by Individuals and Corporations-Risk Management objectives-Need for a Rationale for Risk Management in Organizations- Understanding the cost of Risk-Individual Risk Management and the Cost of Risk-Risk Management and Societal Welfare.

Risk Identification-Business Risk Exposures-Individual Exposures-Exposures of Physical Assets -Exposures of Financial Assets -Exposures of Human Assets -Exposures to Legal Liability - Exposure to Work-Related Injury-Basic concepts form probability and Statistics.

Unit 2:

(8 Hours)

Risk Measurement-Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods-Pooling Arrangements and Diversification of Risk.

Advanced Issues in Risk Management: The Changing Scope of Risk Management-Insurance Market Dynamics-Loss Forecasting-Financial Analysis in Risk Management --Decision Making-Other Risk Management Tools

Unit 3:

(8 Hours)

Introduction to Insurance

Risk and Insurance- Definition and Basic Characteristics of Insurance-Requirements of an Insurable Risk-Adverse Selection and Insurance-Insurance vs. Gambling Insurance vs. Hedging-Types of Insurance-Essentials of Insurance Contracts.

Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India-Liberalization of Insurance Markets-Major players of Insurance.

Regulation of Insurance- Insurance Act 1938- eligibility-Registration and Capital requirement-Investment of assets-Approved investments-Licensing of insurance agents- IRDA-Duties and powers of IRDA-IRDA Act 1999-IRDA regulations for general insurance-reinsurance, life insurance, micro insurance, licensing of insurance agents, registration of insurance companies and protection of policyholders interest.

Unit 4:

(8 Hours)

Life Insurance

Basics of Life Insurance-Growth of Actuarial Science-Features of Life Insurance-Life Insurance Contract-Life Insurance Documents-Insurance Premium Calculations.

Life Insurance Classification-Classification on the Basis –Duration-Premium Payment-Participation in Profit-Number of Persons Assured-Payment of Policy Amount-Money Back Policies-Unit Linked Plans.

Annuities-Need of Annuity Contracts, Annuity V/s Life Insurance, Classification of Annuities.

Unit 5:

(12 Hours)

General Insurance-Laws Related to General Insurance-General Insurance Contract-General Insurance Corporation(GIC)-Performance Private and Public General insurance companies.

Health Insurance-Individual Medical Expense Insurance – Long Term Care Coverage – Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Child Welfare Policy-Employee Group Insurance – Features of Group Health Insurance – Group Availability Plan.

Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage.

Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy.

Motor Vehicles Insurance-Need for Motor Insurance, Types of Motor Insurance, Factors to be considered for Premium Fixing.

Unit 6:

(10 Hours)

Management of Insurance Companies

Functions and Organization of Insurers- Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers.

Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in non-life Insurance.

Claims Management-Claim Settlement in General Insurance-Claim Settlement in Life Insurance.

Insurance Pricing-Insurance Cost and Fair Premiums, Expected Claim Costs, Investment Income and the timing of claims Payments, Administrative Costs, Profit Loading, Capital Shocks and Underwriting Cycles, Price Regulation.

Insurance Marketing: Marketing of Insurance Products, Critical Success factors for Insurance Players, Marketing Strategies in India.

Practical Component

- Analyze the insurance potential in India based on secondary data
- Meet Insurance advisors. Agents and have a discussion on requirements of insurance selling.
- Select insurance company of your interest and study the risk management procedures followed by that company.
- Analyze risk management techniques used by the banks, cement companies, automobile companies.
- Visit the IRDA website and identify the rules and regulations governed by IRDA with respect to Marketing of insurance in rural markets

RECOMMENDED BOOKS

- Risk Management and Insurance, Scott E. Harrington, Gregory R Niehaus, (2007), Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Introduction to Risk Management and Insurance, Dorfman, Mark S., (2008), 10th Edition, Prentice Hall India, New Delhi.
- Principles of Risk Management and Insurance, George E Rejda, (2009), Twelfth Edition, Pearson, New Delhi.
- Insurance and Risk Management, P.K. Gupta, (2010), First Edition, Himalaya Publishing House, Mumbai.

- Principles and Practice of Insurance, P. Periasamy, (2009), Second Edition, Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:

- Risk Management and Insurance, C. Arthur Williams, Jr. Peter Young, Michael Smith, (2007), Eighth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Risk Management and Insurance, James Trieschmann, Obert Hoyt, David Sommer, (2008), Twelfth Edition, Cengage Learning, New Delhi.
- Risk management and Insurance: New Perspective in a Global Economy”, Harold D. Skipper, W. Jean Kwon, (2008), First Edition, Wiley India, New Delhi.
- Fundamentals of Risk and Insurance, Emmett J. Vaughan, Therese Vaughan, (2007), First Edition, Wiley India, New Delhi.

TAX MANAGEMENT

Subject Code	: 16 MBA FM403	IA Marks :20
Number of Lecture Hours/Week	: 03	Exam Hours: 03
Number of Lecture Hours	: 56	Exam Marks: 80
Practical Component	: 02 Hours/ Week	

Course Objectives:

- To provide the students with a comprehensive understanding of residential status in tax laws
- To acclimatize the students with process of computing tax liability of Individuals
- To understand corporate taxation system in the country
- To know the deductions and exemptions available in the tax laws
- To Provide Insight into GST

Course Outcome:

At the end of the course, the students are able to:

- Understand the process of computing residential status.
- Realize the complexities involved in tax liability of Individuals
- Know the corporate tax system.
- Be aware of deductions and exemptions of taxes
- Understand working of GST system in the country

Unit 1:

(8 Hours)

Basic concepts: assessment year, previous year, person, assessee, Income, charges on income, gross total income, capital and revenue receipts, residential status, receipt and accrual of income, connotation of income deemed to accrue or arise in India. Tax Planning, Tax Evasion and Tax Management. (Problems on residential Status of Individual assessee)

Unit 2:

(10 Hours)

Explanation under various heads of income. Income from salary (Basic problems), Income from House Property (Theory Only)

Unit 3: (10 Hours)

Income under the head Profit and Gains of Business or Professions and its computation- basic method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation (Problems on computation of income from business/ profession of Individual assessee and Depreciation).

Unit 4: (12 Hours)

Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain(theory & problems), deductions from capital gains. Income from Other Sources (Theory Only) Permissible deductions under section 80C to 80U. Setoff and carry forward of losses.

Unit 5: (10 Hours)

Computation of tax liability of a firm and partners. Computation of taxable income of a company with special reference to MAT. Corporate dividend Tax

Unit 6: (6 Hours)

Introduction to GST, Levy and exemption, Time and value of supply, Administration of GST. Introduction to **Customs duty**.

Practical Components:

- Understanding the usage of software package while calculating different taxes
- Preparation of Income tax returns of Individual assesses.
- Preparation of sales tax returns
- Studying the online submission of Income tax returns

Recommended Books :

- Direct Taxes Law and practice, Vinod Singhania and Kapil Singhania, Taxman Publications,
- Direct Tax – Lal & Vashisht – Pearson Ed. 28E.
- Students Guide to Income Tax Vinod Singhania and Kapil Singhania, – Taxman Publications
- V S Datey – Indirect Taxes – Taxman Publications.

Reference Books:

- Mehrotra- Direct Tax – SahityaBhavan
- T N Manoharan- Students Guide to Income Tax – Snow White

INTERNATIONAL FINANCIAL MANAGEMENT

Subject Code	: 16MBA FM404	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours/ Week		

Objectives

- To provide an understanding of the international economic and financial environment.
- To explain the foreign exchange rate determination, including the foreign exchange and derivatives markets.
- To describe foreign exchange exposure measurement and management.
- To provide an understanding the financial management aspects of the MNC.
- To explain the functioning of world financial markets and institutions.

Course Outcome:

At the end of the course, the students are able to:

- Be aware of international economic and financial environment.
- Understand foreign exchange rate determination.
- Know foreign exchange exposure measurement and management.
- comprehend the financial management aspects of the MNC.
- Understand the functioning of world financial markets and institutions.

Unit 1:

(6 Hours)

International financial Environment- The Importance, rewards & risk of international finance- Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution

Unit 2:

(10 Hours)

International flow of funds and International Monetary system:-

International Flow of Funds: Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade and capital flows, Agencies that facilitate International flows. BOP, Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility (problems on BOP)

International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).

Unit 3:

(10 Hours)

Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Nominal, Real and Effective exchange rates, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-Cross Rates- -

Arbitrage profit in foreign exchange markets, Swift Mechanism. Triangular and locational arbitrage.

Unit 4: (10 Hours)

International Financial Markets and Instruments: - Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, Cross listing of shares Global registered shares. International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets
International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements

Unit 5: (10 Hours)

International Parity Relationships & Forecasting Foreign Exchange rate: - Measuring exchange rate movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effect. Covered Interest Arbitrage

Unit 6: (10 Hours)

Foreign Exchange exposure: - Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure- Management of political Exposure- Management of Interest rate exposure.

Foreign exchange risk Management: Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Currency Swaps-Interest Rate Swap-Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country risk analysis.

(Question Paper: 50% Theory and 50% Problems)

Practical Component:

- Students can study the Balance of Payment statistics of India for the last five year and present the same in the class.
- Students can carry out a survey of Exporters and report the foreign exchange risk management practices adopted by them.
- Students can study the impact of exchange rate movement on the stock Index.
- Students can visit a bank and study the foreign exchange derivatives offered by them.

RECOMMENDED BOOKS:

- International Financial Management - Jeff Madura, Cengage Learning 2008. International Finance Management - Eun & Resnick, 4/e, Tata McGraw Hill.
- International Financial Management – Madhu Viji, Excel BOOKS, 2010.
- International Financial Management – Apte P. G, 6/e, TMH, 2011
- Multinational Business Finance – Eiteman, Moffett and Stonehill, 12/e, Pearson, 2011.

REFERENCE BOOKS:

- International Financial Management – Siddaiah T, 1/e, Pearson, 2011.
- International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
- International Financial Management – Vyuptakesh Sharan, 6/e, PHI, 2011.
- Multinational Financial Management – Alan C. Shapiro, 10/e, Wiley India Pvt. Ltd., 2011.

- International Financial Management – Jain, Peyrard& Yadav, Macmillan 2010.
- International Finance – Thomas O’Brien, Oxford University Press, 2010.

FINANCIAL DERIVATIVES

Subject Code	: 16MBA FM405	IA Marks	:20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To understand the features of financial derivatives.
- To hedge risk and practice risk management using derivatives.
- Explain the use of options and futures contracts for tactical portfolio strategies purpose
- To provide an understanding of pricing financial derivatives, including familiarity with some central techniques, like the binomial model, and the Black-Scholes model
- To explain the fundamentals of credit risk management and Value at Risk

Course Outcome:

At the end of the course, the students are able to:

- Know the features of financial derivatives.
- Understand the risk management process using derivatives.
- Realize use of options and futures contracts
- Understand the pricing of financial derivatives.
- Be aware of fundamentals of credit risk management and Value at Risk

Unit 1:

(6 Hours)

Financial Derivatives - Introduction, economic benefits of derivatives - Types of financial derivatives - Features of derivatives market - Factors contributing to the growth of derivatives - functions of derivative markets - Exchange traded versus OTC derivatives - traders in derivatives markets - Derivatives market in India

Unit 2:

(12 Hours)

Futures and forwards - differences-valuation of futures, valuation of long and short forward contract. Mechanics of buying & selling futures, Margins, Hedging using futures - specification of futures - Commodity futures, Index futures, interest rate futures - arbitrage opportunities.

Interest rate markets - Type of rates, Determining Zero rates, Forward rate agreements (FRA), Interest rate derivatives.

Unit 3:

(10 Hours)

Financial Swaps - features and uses of swaps - Mechanics of interest rate swaps – valuation of interest rate swaps – currency swaps – valuation of currency swaps.

Unit 4:**(12 Hours)**

Options: Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity - mechanics of options - stock options - options on stock index - options on futures – interest rate options. Concept of exotic option. Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes Model, option Greeks. Arbitrage profits in options.

Unit 5:**(8 Hours)**

Commodity derivatives: commodity futures market-exchanges for commodity futures in India, Forward Market Commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities.

Unit 6:**(8 Hours)**

Credit risk - Bond prices and the probability of default, Historical default experience, reducing exposure to Credit risk, Credit default swaps, Total return swaps, Credit spread options, Collateralized debt obligation. Basics of Interest rate risk and risk management strategies.

Value at Risk (VAR) - Measure, Historical simulation, Model building approach, linear approach, Quadratic model, Monte Carlo simulation, stress testing and back testing

(Question Paper: 50% Theory and 50% Problems)

Practical Components:

- Students can visit a financial institution dealing in derivatives and study the products offered by them
- Students should individually select various futures or options and watch the behavior of these futures and options on a day to day for 15 days to see how futures and options might help mitigate the risks of investors.

RECOMMENDED BOOKS:

- Options Futures & Other Derivatives - John C. Hull, 6/e, Pearson Education.
- Derivatives and Risk Management, Rajiv Srivastava, Oxford University Press, 2010
- Options & Futures- Vohra & Bagri, 2/e, TMH
- Derivatives- Valuation & Risk Management - Dubofsky& Miller, Oxford University Press, 2005.
- An introduction to derivatives and risk management, Chance, Cengage, 9th edition.

REFERENCE BOOKS:

- Derivatives, Principles and Practice, Sundaram& Das, Mc Graw Hill, 2013
- Risk Management, VaijanathBabshetti& Prakash B. Yaragol, 1st edition, Kalyani Publishers, 2014.
- Introduction to Derivatives and Risk Management – Don M. Chance, Cengage Learning, 2008.
- Financial Derivatives- Bishnupriya Mishra and SathyaSwaroopDebashish, Excel BOOKS, 2007.
- Options & Futures –Edwards & Ma, 1/e, McGraw Hill.

- Derivatives & Financial Innovations - Bansal, TMH.
- Financial Derivatives –Kumar S. S. S, PHI, 2007.
- Futures, Options and Swaps – Robert W. Kolb, 5/e, Wiley India Pvt. Ltd. 2011.

CORPORATE VALUATION

Subject Code	: 16MBA FM406	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Objectives:

- To identify the purpose of corporate valuation and to obtain an overview of the basic corporate valuation process
- To familiarize the students with the standard techniques of corporate valuation.
- To develop analytical skills and communication strategies for discussing corporate valuation.
- To assess a firm's business and competitive strategy and whether it is creating value for shareholders

Course Outcome:

At the end of the course, the students are able to

- Get an overview of the basic corporate valuation process
- Be familiar with the standard techniques of corporate valuation.
- Understand analytical skills and communication strategies for corporate valuation.

Unit 1: (8 Hours)

Corporate valuation-an Overview-Context of valuation-Approaches to Valuation-Features of the valuation process: Book value approach, Stock and debt approach, discounted cash flow approach, Relative valuation approach, option valuation approach-Features of the valuation process-Corporate valuation in practice.

Unit 2: (12 Hours)

Enterprise DCF Model-Analysing historical performance-Estimating the cost of Capital-Forecasting performance-Estimating the continuing value-Calculating and interpreting the results-Other DCF models: Equity DCF Model: Dividend discount model, free cash flow to Equity (FCFE) model-Adjusted present value model-Economic profit model-Applicability and Limitations of DCF analysis

Unit 3: (10 Hours)

Relative valuation-Steps involved in Relative valuation-Equity valuation multiples-Enterprise valuation multiples-Choice of multiple-Best practices using multiples-Assessment of relative valuation.

Other Non DCF Approaches-Book Value approach-Stock and Debt approach-Strategic approach to valuation-Guidelines for corporate valuation

Unit 4: (8 Hours)

Advanced issues in valuation-Valuation of companies of different kinds-valuation in different contexts-Loose ends of valuation-Valuation of intangible assets: Patents, trademarks, copyrights and licenses; Franchises; Brands

Unit 5: (10 Hours)

Value Based Management- Methods and Key premises of VBM-Marakon approach-Alcar approach-Mckinsey approach-Stern Stewart approach-BCG approach-Lessons from the experiences of VBM adopters.

Unit 6: (8 Hours)

Case studies in Valuation - Bharat Hotels company - Bharat Heavy Electricals Limited - Bhoruka Power Corporation Limited - Valuation in the Merger of ICICI with ICICI Bank - Sasken Communication Technologies - Valuation of Infosys Brand

(Question Paper: 50% Theory and 50% Problems)

Practical Component:

- Obtain last three years' balance sheet of any firm that has debt and equity and find out the free cash flow to the firm and free cash flow to the equity for the last three years. Also determine if there is any growth in the cash flows to the firm and to the equity holders. Find beta of the firm and compute cost of equity and WACC to finally find the value of the firm

RECOMMENDED BOOKS

- Corporate Valuation and Value Creation, Prasanna Chandra, Tata McGraw Hill, 2011.
- Valuation, AswathDamodaran, Damodaran, 2/e, John Wiley and Sons, 2006.

REFERENCE BOOKS

- Corporate Valuation: A Guide for Managers and Investors, Philip R Daves, Michael C. Ehrhardt, and Ron E. Shrieves, , Cengage Learning,2003
- Corporate Valuation Financial Times, David Frykman, JakobTolleryd, Prentice Hall, 2003.
- The Valuation Handbook: Valuation Techniques from Today's Top Practitioners, Rawley Thomas, Benton E. Gup, John Wiley & Sons, 2010
- Financial Management, Rajiv Srivastava and Anil Misra, 2/e, Oxford University Press, 2011.

**SEMESTER IV
Human Resources Management**

PUBLIC RELATIONS

Subject Code	: 16MBA HR401	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03

Total Number of Lecture Hours : 56
Practical Component : 02 Hours / Week

Exam Marks : 80

Course Objective:

- To provide an understanding of the fundamentals tools of public relations practice
- To provide a multidisciplinary understanding of the emerging trends in the field of public relations.

Course Outcomes:

The students will be able to

- Gain the insights of Public relations principles and practices.
- Learn the various theories of mass communication
- Understand the various issues in crisis management

Unit 1: (8 Hours)

Public Relation: Meaning, Concepts of PR -Proactive and Reactive Approaches – Public Relations Process – Behavioral Public Relations Model – Persuasion Model – Two way symmetrical Communications Model – 20 great truths about Public Relations

Unit 2: (8 Hours)

Theoretical basis for Public Relations –Theories of Relationships –Systems Theory – situational Theory – Theories of Persuasion and Social Influence – Social Exchange Theory – Diffusion Theory – Social Learning Theory – Elaborated Likelihood Theory - Theories of Mass communication – Uses and Gratification Theory – Agenda Setting Theory – Public Relations roles – Models of Public Relations – Approaches to Conflict Resolutions

Unit 3: (10 Hours)

Employee communications – Role of employee communication – concept of Organizational culture – Establishing Communication Policy – Organizational change – Importance of employee communication – Special employee Communication Situations – Media of Employee communications – Objectives of Internal media – Starting internal media – controlling internal media - Occasional and Special media Rules of Effective Employee Relations. Frontline supervisors as the key communicators

Case: Investing in Employees Pays Off (CJSS)

Case: Southwest Airlines – Where Fun, LUV, and Profit Go Hand –in Hand (CJSS)

Case: Employee Retention: It is the employer who is on probation (LLHT)

Case: Maintaining Employee Relationship in a Tragedy (LLHT)

Kodak Communicates One - on - One with All of its Employees (CJSS)

Unit 4: (8 Hours)

Community Relations – Importance of Public Relations – Community Relations Process – Guidelines for Effective Relations Programs -Specific Functions of Public Relations – Criteria for Community relations Activities – Corporate Social Responsibility & Philanthropy-Emerging Challenge of Community Activism

Case: Community Relationships Maintained During Hospital Closing (CJSS)

Unit 5: (8 Hours)

Media Relations – Media Relations –Role of Media in Public Relations – Social Media – working with the media –Media Relations Program Elements –Role of Technology in Public Relations

Case: Fatal Tiger Attack at San Francisco Zoo (LLHT)

Case: There's a Syringe in My Pepsi Can (CJSS)

Unit 6:

(14 Hours)

Issues in Public Relations/Crisis Management – public relations challenges –Types of Issues - target audiences-Public Service as Preventive Public Relations – Special Interests – Importance of Compromise –Issue Anticipation – Scenario Technique.

Crisis Management – Understanding how people typically react to issues – Human Nature – Role of communications – Types of crises – News media influence - Fundamental guidelines

Case: Take your choice – Tobacco or Health (CJSS)

Case: Bhopal – A Nightmare for Union Carbide (CJSS)

Practical Component:

- Related cases for each module to be discussed in the classes and presentation can be done for each case by group of students.
- Team of students can be made and asked to report the media personalities about the event held in the college. Different styles of reporting the same event can be discussed in the class with its possible reactions from the media.
- Collect the newspaper articles about various messages from organizations through spokespersons and analyze the effect of each type of delivery and impact on the audience.
- Conduct a CSR Programme for the college like Blood donation, Eye camps in association with Lions, Rotary clubs etc and gather the information's about various challenges these organizations face during such community oriented programmes.

RECOMMENDED BOOKS

- “Public Relations – The Profession and Practice”, Lattimore, Laskin, Heiman &Toth, third edition, Tata McGraw Hill, 2012 (LLHT)
- “Public Relations Practices – Managerial Case Studies and Problems” Center, Jackson, Smith and Stansbury, Seventh Edition, Prentice Hall of India, 2008 (CJSS).
- Public Relations - Paul Baines, John Egan, Frank Jefkins, Routledge, 3rd edition, 2007.
- Public Relations: Concepts, Practice and Critique, Jacquie L'Etang, SAGE, 2007.
- Public Management – Organizations, Governance and Performance, Laurence J. O' Toole Jr, Kenneth J Meier, 1st edition, Cambridge Publications, 2011.

REFERENCE BOOKS:

- Strategic Planning for Public Relations, Ronald D. Smith, revised edition, Taylor & Francis, 2004.
- Public Relations: A Practical Guide to the Basics, Philip Henslowe, 1st edition, Kogan Page Publishers, 2003.
- An Overview of the Public Relations Function - Shannon A. Bowen, Reprint Edition, Business Expert Press, 2010.
- Public Relations Practices, Managerial Case Studies and Problems, Allen H Center, Patrick Jackson, Stacey Smith, Frank R Stansberry, 7th Edition.

WORKPLACE ETHICS AND VALUE SYSTEMS

Subject Code	: 16MBA HR402	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03

Total Number of Lecture Hours : 56
Practical Component : 02 Hours / Week

Exam Marks : 80

Course Objectives:

- To understand the ethical practices at workplace.
- To address the ethical issues which arise in the work environment.
- To acquaint students with various ethical problems at work place.

Course Outcomes:

The students will be able to

- Learn the principles and practices of workplace ethics.
- Understand the concepts of corporate governance and ethics.
- Gain insights of Discrimination and Harassment at Workplace

Unit 1: (8 Hours)

Workplace Ethics: Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behavior in workplace- Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Benefits of ethics in Workplace-employee commitment, investor loyalty, customer satisfaction, profits

Unit 2; (8 Hours)

Professionalism at Workplace: Unethical Conduct for employees and employers. Factors leading to Unethical Behaviors. Different unethical behaviors. Measures to control unethical behaviors. Rewarding ethical behavior

Unit 3: (10 Hours)

Business Ethics and Corporate Governance: Overview of Business Ethics, Corporate Governance, Ethical issues in human resource management- The principal of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethics in retrenchment. Ethical Dilemmas at workplace, Ethical issues in global business, corporate responsibility of employers.

Unit 4: (10 Hours)

Workplace Privacy & Ethics: Watching what you say and what you do in the workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, Convenience and Death of Privacy, Defence of employee privacy rights.

Unit 5; (12 Hours)

Teamwork in the Workplace, Ethics, Discrimination and Harassment at Workplace & Ethics: Teams, Elements of team, Stages of team development, team meetings, team rules, and teams work and professional responsibility, rules of professional responsibility, ASME code of ethics. Discrimination, sexual harassment, creating awareness about workplace harassment, Vishaka Dutta vs. State of Rajasthan –Supreme Court directions, Compulsory workplace guidelines.

Unit 6: (8 Hours)

Managing Change in Workplace through Ethics: Introduction to Change Management, Models of change, the Ethics of Managing Change, the role of ethics and responsibilities in leading innovation and change, ethics based model for change management, ethics and risks of change management

Practical Components:

- To solve case studies on Workplace Ethics
- To visit organizations and find out the problems and causes for unethical behavior at workplace.
- To visit organizations and find out the measures adopted to control unethical behavior of employees.
- To compare and contrast the various ethical codes of conduct practiced in organizations.
- To study the recent cases on breach of workplace privacy.

RECOMMENDED TEXT BOOKS:

- Ethical Theory and Business, Tom L. Beauchamp, Norman E. Bowie and Denis Arnold, 8th Edition.
- Business Ethics – Ethical Decision making and cases O.C. Ferrell, John Fraedrich, and Linda Ferrell, 9th Edition, Cengage Learning.
- How technology is compromising Workplace Privacy, Fredrick S Lane 111, AMACOM Div American Mgmt Assn, 2003
- Ethics in the Workplace, Dean Bredeson, Keith Goree, Cengage Learning, 2011.

REFERENCE BOOKS:

- Ethics in 21st Century, Mary Alice Trent, Oral Roberts University, longman.
- Ethics in workplace, Elizabeth P Tierney, Oak tree press
- Ethics in Workplace: System Perspective, William F Roth, Pearson, 2014.
- Ethics in the Workplace: Tools and Tactics for Organizational Transformation - Craig E. Johnson - SAGE Publications, 2007
- Business Ethics: Fairness and justice in the workplace - Volume 2 of Business
- Ethics, Fritz Allhoff, ISBN 1412902541, 9781412902540 - SAGE Publications, 2005

INTERNATIONAL HUMAN RESOURCE MANAGEMENT

Subject Code	: 16MBA HR403	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To analyze the impact of contemporary issues and global imperatives on Human Resource concepts
- To learn the policies and practices in multinational organizations
- To compare, contrast and explain a variety of strategic approaches to the management of Human Resources in multinational organizations.

Course Outcomes:

The students will be able to

- Apply the concepts and knowledge about the range of Human Resource functions.
- Deploy the expatriate employees and expatriate failures on international assignments.
- Evaluate the effects of different Human Resource and International Industrial Relations strategies adopted by multinational organizations

Unit 1: (10 Hours)

Introduction to IHRM Definition, The drivers of internationalization of business. The different setting of International Human Resource Management. Development of IHRM. Difference between IHRM and Domestic HRM. Models of IHRM-Matching model, Harvard Model, Contextual Model, 5P Model European Model. SHRM: Evolution of MNE's, Business strategies, IHRM Strategies, SIHRM. Barriers in effective global HRM. Socio-cultural context, Organizational dynamics and IHRM: Role of culture in International HRM, Country and Regional Cultures, Country Culture versus MNE Culture. Culture and employee management issues/ impact of Country culture on IHRM.

Unit 2: (7 Hours)

Strategies for International Growth: Exploiting global integration-The logic of global integration, differentiation, Mastering expatriation, beyond the traditional expatriate model, the limits of global integration. Becoming locally responsive: The roots of responsiveness, understanding diversity, responding to diversity, the challenges of localization. Managing alliances and joint ventures - IHRM and International Alliances, IHRM and International Joint Ventures.

Unit 3: (10 Hours)

International Workforce planning and staffing: International labour market International Recruitment function; head-hunters, cross-national advertising, e-recruitment; International staffing choice, different approaches to multinational staffing decisions, Types of international assignments, Selection criteria and techniques, use of selection tests, interviews for international selection, international staffing issues, Successful expatriation, role of an expatriate, female expatriation, repatriation, re-entry and career issues.

Unit 4: (7 Hours)

Developing Global Mindset: Global Leadership, Cross cultural context and international assignees, Current scenario in international training and development, training & development of international staff, types of expatriate training, sensitivity training, Career Development, repatriate training, developing international staff and multinational teams, knowledge transfer in multinational companies.

Unit 5: (8 Hours)

Performance Management: Performance Management and MNE, Constraints in goal attainment, performance management cycle, Performance Management of International Assignees, third and host country employees, issues and challenges in international performance management, country specific performance management practices.

Unit 6: (14 Hours)

International Compensation and International Employment Laws and HRIS: International compensation and international assignees, Forms of compensation, key components of international compensation, Approaches to international compensation, compensation practices across the

countries, emerging issues in compensation management. Establishment of labour standards by International Institutions, The global legal and regulatory context of MNE, The International framework of Ethics and Labour standards, Key issues in International Industrial Relations, Trade Unions and MNE's, Response of Trade Unions to MNE's, Non-Union worker representation. HRIS: Meaning, Role of IT in HR, Designing of HRIS, Applications of HRIS in Employee Management, Limitation of HRIS.

Practical Component:

- Study the Socio-Political-Economic System in U.S, U.K, Japan and India and prepare a comparative analysis.
- Visit an MNE organization and study the HR shared services operations performed.
- Solve a case study to understand the challenges faced by organizations in evaluating the performance of international assignees.
- Study and compare Recruitment, Selection and Training practices in various countries.
- Study Indian and US legal aspects involved when deploying an employee on an International Assignment.

RECOMMENDED BOOKS:

- International Human Resource Management - Peter J. Dowling, MavinFesting, Allen D Englesr Cengage Learning.
- International Human Resource Management - Monir H. Tayeb, Oxford University Press, 2005.
- Human Resource Information Systems: Basics, Applications, and Future Directions: Basics, Applications, and Future Directions, Michael J. Kavanagh, Mohan Thite, Richard D. Johnson SAGE, 2011, 2/e.
- Strategic International Human Resource Management: Choices and Consequences in Multinational People Management - Stephen J. Perkins, Susan M. Shortland – Kogan Page Publishers, 2006.
- Strategic Human Resource Management, Schuler, 2/e, Wiley.

REFERENCE BOOKS:

- International Human Resource Management: Text and Cases By P. L. Rao, Excel Books, Reprint
- International Human Resource Management: Policies and Practices By Dennis Briscoe, Randall Schuler, IbraizTarique, Taylor & Francis, 4/e, 2012.
- International Human Resource Management - Anne-Wil Harzing, Joris Van Ruysseveldt - SAGE, 2004.
- International human resource management: think globally, act locally – Derek Torrington - Prentice Hall, 1994.

ORGANISATION CHANGE AND DEVELOPMENT

Subject Code	: 16MBA HR404	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To understand the concepts of change management and to acquire the skills required to manage any change effectively.
- To understand the various components and constraints involved in Change management.
- To learn the various tools & techniques for Organization Development
- To understand the different OD interventions and its effectiveness.

Course Outcomes:

The students will be able to

- Gain insights of change management components, process and its functions
- Enable with various OD diagnosing models
- Ability to handle various OD interventions.

Unit 1: (8 Hours)

Organizational change- Introduction, nature of change, Internal & External changes, types of change, **Models of change-** Lewis's Force field, Systems Model, Action research model, organizational vision and strategic planning.

Unit 2: (8 Hours)

Resistance to change- reasons for the resistance, overcoming resistance for the change, change and person and manager, systematic approach to making change- factors for effective change, skills of leaders in change management, designing the change.

Unit 3: (8 Hours)

Organization development-Introduction, history, evolution of OD, OD interventions: Definition, actors to be considered, choosing and sequencing, intervention activities, classification of OD interventions, results of OD, typology of interventions based on target groups.

Process of Organization Development: Entering into OD relationship, developing a contract.

Unit 4: (8 Hours)

Diagnosing Organizations- Need for diagnostic models, organization, group, individual level diagnosis, Collecting and analyzing the diagnostic information, Feeding Back of diagnostic information, Designing interventions, overview of interventions, evaluating and Institutionalizing OD Interventions.

Unit 5: (12 Hours)

Human Process Interventions: Human process interventions (individual, group and inter-group human relations): **Individual based:** coaching, counselling, training, behavioral modelling, delegating, leading, morale boosting, mentoring, motivation, etc., **Group based:** conflict management, dialoguing, group facilitation, group learning, self-directed work teams, large scale interventions, team building, and virtual teams.

Inter-group based: Organization mirroring, third party peacemaking interventions.

Unit 6: (12 Hours)

Techno-structural Interventions and Future of OD: Restructuring Organizations, Employee Involvement, work Design, Balanced scorecard; business process reengineering; downsizing and outsourcing; **Strategic Interventions:** Competitive and Collaborative Strategies, Organization Transformation.

The Future of OD: The changing environment, Fundamental strengths of OD, Implications of OD for the client, ethical standards in OD, OD's future. **OD Consultant's role**, issues in consultant-client relationship, Power, Politics & OD, Research on OD.

Practical Component:

- To conduct Force field analysis for MBA department
- Group activity-Identify the need for OD intervention for your college and call the director/principal of your college to the classroom to explore the possibility for OD intervention.
- Presentation by students: Identify and explore the possibility for OD intervention in your college level, group level and individual level.
- Hold a debate in the classroom about downsizing the workforce.
- Organization change questionnaire data collection and analyzation.
- Group Presentation: Health care, FOO, Education, PSU, Retail, Manufacturing Industries.
- Design a role play event for students, so that they will play it out to mobilize support for a change implementation programme.

RECOMMENDED BOOKS:

- Theory of Organization Development and Change. Thomas G. Cummings, Christopher G. Worli, Cengage Learning.
- Understanding the theory and design of organization, Richard L Draft, Cengage Learning.
- Organization Development, behavioral science interventions for Organization Improvement, Wendell French, Cecil H.Bell, Veena, Jr, Pearson, PHI.
- Organization Change and Development, Kavith Singh, Excel BOOKS.

REFERENCE BOOKS:

- Change & Knowledge Management-R.L. Nandeshwar, Bala Krishna Jayasimha, Excel BOOKS, 1st Ed.
- Management of Organizational Change – K Harigopal – Response BOOKS, 2001
- Organizational, Design, and Change-Gareth R. Jones, 5th Edition, Pearson Education

STRATEGIC TALENT MANAGEMENT

Subject Code	: 16MBA HR405	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To aware the challenges of acquisition and retention of talents for the competitive advantage of the organization.
- To develop a conceptual understanding of the management of talents in the competitive environment.
- To understand how important is to develop and retain the best talents in the industry.
- To understand the concepts of competency and its usage in evaluating a person's work.
- To get an idea about different tools in identifying required competencies in a person.

Course Outcomes:

The students will be able to

- Gain the insights of talent management practices in organization.
- Learn the techniques and retail the best talent in industry.
- Prepare competency mapping.

Unit 1: (10 hours)

Basics of Talent Management: Talent- engine of new economy, difference between talents and knowledge workers, leveraging talent, the talent value chain, elements of talent friendly organizations, talent management process, **Talent Management System** – Components and benefits of Talent Management System; creating TMS, challenges of TMS, **Building blocks of talents management:** competencies – performance management, conducting performance reviews, Appraising executive talent, selecting the right appraisal.

Unit 2: (8 hours)

Talent Planning – Concept, succession management process, Integrating succession planning and career planning, designing succession planning program, strategic accountability approach in developing the workforce, balanced scorecard, talent development budget, contingency plan for talent; building a reservoir of talent, compensation management within the context of talent management, CEO Succession planning,

Unit 3: (6 hours)

Developing and Retaining Talent – Potential identification and development, coaching for sustained & desired change, integrating coaching, training and development with talent management ,employee retention- motivation and engagement, Return on talent; age of analytics, making outplacement as a part of talent strategy, developing talent management information system.

Unit 4: (6 hours)

Competency mapping: Concepts and definition of competency; types of competencies, competency based HR systems, competency and performance, 5 level competency model, developing various competency models, how competencies relate to career development and organizational goals.

Unit 5: (14 hours)

Methodology of competency mapping : competency model development ,competency models, people capability maturity model ,developing competency framework , competency profiling , competency mapping tools , use of psychological testing in competency mapping , competency based interviewing , assessment of competencies through 360 degree feedback, BEI, CIT, validation of competencies.

Unit 6: (12 hours)

Measuring Performance, Assessment and Development Centre: background and approaches to performance assessment, competency based performance assessment, diagnosing reasons for performance problems, designing an effective performance management systems, sources of errors in performance measurement.

Assessment and Development Centre : concepts , importance and uses of assessments centre in selecting employees , difference between assessment and development centre, assessment centre

approach to competence building , profile of the assessors, steps in assessment centre, designing the assessment centre.

Practical Component:

- Students are expected to conduct a study on how talents are acquired and retained – in various industries – and various strategies followed by the respective companies.
- Discussion on “How to have/ evaluate the performance of the MBA students”
- Ask the students to find out the best employer surveys conducted during the past one year and make a presentation.
- Identify the important positions in your college or any other organization and ascertain the measures if any taken to develop second line of leadership
- Ask the students to collect data about the position of principal, director, and other teachers in your college and prepare a competency dictionary for the said positions
- Presentation by students about the competency directory profiling of various positions.
- Ask the students to role play the behavioural event interview to collect data for competency mapping for the position of management professor.
- Presentation by students about the competency directory profiling of various positions.

RECOMMENDED BOOKS:

- The Talent Management Hand Book – Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill
- Competence at work – Lyle M. Spencer, Signe M. Spencer. John Wiley, 1993.
- A Handbook of Competency Mapping – Seema Sangi, Response BOOKS, 2004.
- Competency mapping, Assessment and Growth – Naik G.P, IIHRM, 2010.

REFERENCE BOOKS:

- The Talent Era, Chowdhary, Subir, Pearson Education, New Delhi.
- Appraising & Developing Managerial Performance- Rao T. V, Excel BOOKS
- Performance Management – Herman Aguinis, Pearson Education, 2007.
- Performance Management, Rao, Wiley.

PERSONAL GROWTH AND INTERPERSONAL EFFECTIVENESS

Subject Code	: 16MBA HR406	IA Marks	: 20
No. of Lecture Hours / Week	: 03	Exam Hours	: 03
Total Number of Lecture Hours	: 56	Exam Marks	: 80
Practical Component	: 02 Hours / Week		

Course Objectives:

- To identify strengths and weaknesses as an individual, as a member of a group/organization using personality types.
- To understand the concepts of self awareness, self esteem, NLP and Locus of Control.
- To understand Interpersonal growth and effectiveness.

Course Outcomes:

The Students will be able to:

- Understand the components of personal growth.
- Gain insights in the aspects of interpersonal growth and handling conflicts, managing time, self analysis to name a few.

Unit 1: (12 Hours)

Personal growth: Meaning, nature and scope of personal growth. Self-awareness and self-esteem, life roles, social roles and organizational roles, role clarity and role boundaries. Ego states- Id, ego and super ego and defense mechanisms; developing a self improvement plan.

Interpersonal Trust: Discovering facets of interpersonal trust through Johari Window (Openness, confidentiality, blind spot and unknown part of personality); Self disclosure, seeking feedback, self reflection and practicing new behaviors.

Unit 2: (8 Hours)

Understanding Human Personality: Personality – Meaning & Determinants; Personality theories, Carl Jung's theory of personality Types and Myers Briggs Type Indicator test (MBTI), Trait theories- Guilford Peogut, PF 16 and Type A and B Personalities; Emotional intelligence – Meaning, Dimensions, and Emotionally intelligent Organizations.

Unit 3: (8 Hours)

Attitudes, beliefs, Values and their impact on behavior; Personal change- meaning, nature and requisites. Locus of control. **Habit Formation** - Habits of personal effectiveness. Seven habits of highly effective people.

Unit 4: (8 Hours)

Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming (NLP).

Unit 5: (6 Hours)

Interpersonal relations and personal growth: Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, Time management and honoring the commitments

Unit 6: (14 Hours)

Transactional Analysis: Ego states, types of transactions and time structuring. Life position, scripts and games; strokes and stamps

Experiential learning methodologies: T-group sensitivity training, encounter groups and appreciative enquiry.

Practical Components:

- Students are expected to conduct an in depth study about various personality traits & TA and submit a detailed report.
- Students have to undergo psychometric test like MBTI, FIRO-B, Big Five etc , conduct SWOT analysis and prepare a personal growth plan based on the results

- Ask the individual students to seek multisource feedback about their interpersonal effectiveness from peers, teachers, and parents; understand and reflect the feedback and prepare a development plan for interpersonal effectiveness.
- Discuss a Johari Window case in the class to identify how it can help each individual student to promote his/ her personal growth.
- Organize a workshop on MBTI for the students to know their type and to understand the type dynamics.
- Organize a neuro linguistic programming workshop for the participation of all HR students.

RECOMMENDED BOOKS:

- Organizational Behaviour: Human Behavior at work – John W. Newstrom and Keith Davis, 11/e, Tata McGraw Hill, 2003.
- Human Relations in organizations - Robert N. Lussier, 6/e, Mc-Graw Hill Education.
- Development of Management Skills - Whetten& Cameron, 7/e, PHI.
- Competency Mapping Assessment and Growth - Naik G.P, IHRM, 2010.

REFERENCE BOOKS:

- Understanding OB - Udai Pareek, Oxford University Press.
- Theories of Personality- Calvin S Hall, 4/e, Wiley India Pvt. Ltd.
- Seven habits of highly effective people - Stephen R Covey, Pocket Books.
- Training in interpersonal Skills- Stephen Robbins, Pearson Education.

**GUIDELINES FOR INTERNSHIP STUDY (16MBAIN307)
(BETWEEN 2ND AND 3RD SEMESTER MBA)**

OBJECTIVE

To expose the students to understand the working culture of the organization and apply theoretical concepts in real life situation at the work place for various functions of the organization.

STRUCTURE

The Internship shall consist of Study of an organization for 4 weeks.

GENERAL GUIDELINES

- The Internship shall be for a period of 4 weeks immediately after the completion of 2nd Semester Examinations but before the commencement of the 3rd semester classes
- The Subject code of the project work report shall be 16MBAIN307 and shall be compulsory for all the students.
- No two students of an institute shall work on the same organization.
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance. Student need to identify an external guide (Working in the organization) and seek guidance from him/her.

Format of the internship report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1” margin all sides and 1.5line spacing. The internship report shall not exceed 60 pages.

Submission of Report: Students shall submit one hard copy of the report to the college and a soft copy in PDF file (Un-editable Format).

Evaluation:

- Internal evaluation will be done by the internal guide.

- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective institution where a student is expected to give a presentation of his/ her work. The viva –voce examination will be conducted by the respective HOD or Senior Professor or internal Guide of the department and an external evaluator drawn from industry. In case of non availability of industry person, a senior professor or a faculty with more than 10 years of experience may be invited to conduct the viva-voce. Internship work carries 100 marks consisting of 50 marks for internship report (evaluated by internal guide and 50 marks for viva-voce examination)

Contents of the Internship Report

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution(scanned copy) indicating bonafide performance of internship by the student
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction about the internship, Industry Profile.

Chapter 2: Organization Profile:

- i. Back ground,
- ii. Nature of business,
- iii. Vision mission, quality policy
- iv. Product/service profile
- v. Ownership pattern
- vi. Achievements/awards if any
- vii. Future growth and prospects

Chapter 3: Mckensy's 7S framework with special reference to organization under study.

Chapter 4: SWOT Analysis

Chapter 5: Analysis of financial statement. in brief.

Chapter 6: Learning experience.

Bibliography

Annexure relevant to the Internship study such as figures, graphs, photographs etc.,

GUIDELINES FOR 10 WEEK PROJECT WORK (16MBAPR407) (BETWEEN 3RD AND 4TH SEMESTER MBA)

OBJECTIVE

To expose the students to understand the working of the organization/ company / industry and take up an in-depth study of an issue / problem in the area of specialization.

GENERAL GUIDELINES

- The project work shall be for a period of 10 weeks immediately after the completion of 3rd Semester Examinations but before the commencement of the 4th semester classes
- The Subject code of the project work report shall be 16MBAPR407 and shall be compulsory for all the students opting for all specializations.
- The University shall receive 3 copies of project reports prior to the commencement of the 4th semester examination. Copies of the project report should be sent to the concerned Regional Office with an intimation to the Registrar (Evaluation)
- No two students of an institute shall work on the same problem in the same organization
- The student shall seek the guidance of the internal guide on a continuous basis, and the guide shall give a certificate to the effect that the candidate has worked satisfactorily under his/her guidance.
- On completion of the project work, student shall prepare a report with the following format.
- The Project report shall be prepared using word processor viz. MS Word with New Times Roman, 12 font size
- All the reports shall be printed in the A4 size 1” margin on all the sides.

- The report shall be hard bound facing sheet indicating the title of college and month & year of admission (spiral binding not permitted)
- A certificate by the guide, HOD and Head of the institution indicating the bonafide performance of the project by the student to be enclosed.
- An undertaking by the student to the effect that the work is independently carried out by him.
- The certificate from the organization.
- Acknowledgement
- Executive Summary

Schedule to be followed before commencement of Project

Activity	Time line	Remarks
<ul style="list-style-type: none"> • Identifying the organization • Problem identification 	First two weeks	Student individually identifies an organization and identifies problem for his/her study, according to his/her interest.
Problem statement	3rd week	His/ Her interests are discussed with selected guides
Research Design	4th week	Discussion with Internal Guide to decide on suitable design for the research
Synopsis Preparation	5th and 6th week	Preparation of Synopsis* incorporating the objectives

Presentation of Synopsis	7th and 8th week	The student will present the synopsis with the detailed execution plan to the Internal Guide and HOD who will review and may: a. Approve b. Approve with modification or c. Reject for fresh synopsis
Approval Status	9th and 10th week	The approval status is submitted to HOD who will officially give concurrence for the execution of the Project

*Synopsis: It is a three page document or hard copy to be submitted to the HOD with the signatures of the Guide and the student.

Page 1	Title, Contact Address of student- with details of Internal and External Guide
Page 2	Short introduction with objectives and summary (300 words). Review

	of Articles / Literature about the topic with source of information
Page 3	Time Activity Chart

Schedule to be followed during Project work

Activity	Time Line	Remarks
Understanding Structure, Culture and functioning of the organization	First 2 weeks of Project	Student should understand products/services and the problems of the organization.
Preparation of Research instrument for data collection	3rd and 4th week of Project	Discussion with the guide for finalization of research instrument in his/her domain and present the same to the guide. (First Presentation)
Data collection	5th and 6th week of Project	Data collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. (Second Presentation)
Analysis and finalization of report	7th and 8th week of Project	Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use Statistical Package whose

		result should be shown in the report) (Third Presentation)
Submission of Report	9th and 10th of Project	Final Report should be submitted to the University before one week of the commencement of theory examination

Evaluation:

- Internal evaluation will be done by the internal guide.
- External valuation shall be done by a faculty member of other institute drawn from VTU affiliated institute with minimum of 10 years of experience.
- Viva-Voce / Presentation: A viva-voce examination shall be conducted at the respective Institution where a student is expected to give a presentation of his/ her work.
- The viva –voce examination will be conducted by the respective HOD / Senior Professor of the department and an expert drawn from the VTU affiliated institutes with minimum of 10 years of experience as appointed by the University.
- Project work carries 200 marks consisting of 50 marks for internal valuation by the internal guide, 50 marks for external evaluation and 100 marks for viva-voce examination.
- **Format of the project report** shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout

of A4 size with 1” margin all sides and 1.5 line spacing. The Project report shall not exceed 100 pages.

- **Submission of Report:** Students should submit the Project Report in electronic data form only, in **PDF** file (Un-editable Format) to the Institute. The Institute in turn shall submit all the CD’s of their students along with a consolidated master list as per specialization containing USN, Name of the student, and Title of the Report to Registrar (Evaluation) one week before the commencement of the Theory Examinations.
- **Plagiarism:** Plagiarism is considered as academically fraudulent, and an offence against University academic discipline. The University considers plagiarism to be a major offence, and subject to the corrective procedures. It is compulsory for the student to get the plagiarism check done before submission of the project report. Plagiarism of up to 25% is allowed in the project work and report should consist 75% of original content/work.
- **Publication of Research Findings:** Students are expected to present their research findings in Seminars/Conferences/Technical/Management Fests or publish their research work in Journals in association with their Internal Guide. Appropriate Weightage should be given to this in the internal evaluation of the project report.

Contents of the Project Report

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy)
- indicating bonafide performance of Project by the student

- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive summary

Chapter 1: Introduction

Introduction, Industry profile and company profile: Promoters, vision, Mission & Quality Policy. Products / services profile areas of operation, infrastructure facilities, competitors' information, SWOT Analysis, Future growth and prospects and Financial Statement

Chapter 2: Conceptual background and Literature review

Theoretical background of the study, Literature review with research gap (with minimum 20 literature reviews).

Chapter 3: Research Design

Statement of the problem, Need for the study, Objectives, Scope of the study, Research methodology, Hypotheses, Limitations, Chapter scheme.

Chapter 4: Analysis and Interpretation

Analysis and interpretation of the data- collected with relevant tables and graphs. Results obtained by the using statistical tools must be included.

Chapter 5: Findings, Conclusion and Suggestions

Summary of findings, Conclusion and Suggestions / Recommendations

Bibliography

Annexure relevant to the project such as figures, graphs, photographs etc.,

Marks allocation for IV Semester Project Report

Evaluation by Internal guide

SL. No	Aspects	Marks
01	First Presentation	05
02	Second Presentation	05
03	Third Presentation	10
04	Introduction and Methodology	05
05	Industry and Company Profile	05
06	Theoretical background of study	05
07	Data analysis and interpretation	10
08	Summary of findings, suggestions and conclusion	05
	Total	50

Evaluation by faculty member drawn from VTU institutions.

SL. No	Aspects	Marks
1	Introduction & Relevance of the project	10
2	Conceptual background and literature review	05
3	Research design	05
4	Analysis and interpretation	20
5	Summary of findings, suggestions and	10

	conclusion	
	TOTAL	50

Viva voce conducted by HOD/Internal Guide and an Expert from VTU.

SL. No	Aspects	Marks
1	Presentation skill	10
2	Communication skills	10
3	Subject knowledge	20
4	Objective of the study or methodology	20
5	Analysis using statistical tools and statistical packages	20
6	Findings and appropriate suggestions	20
	TOTAL	100

Formats for Project Report and Evaluation

- Format of Cover Page
- Format of certificate by College/Institution
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

(Title of the Report)

BY

(Student Name)
(USN)

Submitted to

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
In partial fulfillment of the requirements for the award of the degree of

MASTER OF BUSINESS ADMINISTRATION

Under the guidance of

INTERNAL GUIDE
(Name)
(Designation)

EXTERNAL GUIDE
(Name)
(Designation)

(Institute Logo)

Department of MBA
(Institute Name with Address)

(Month & Year of submission)

CERTIFICATE

This is to certify that **(Name of the Student)** bearing USN (xxxx), is a bonafide student of Master of Business Administration course of the Institute (Batch), affiliated to Visvesvaraya Technological University, Belgaum. Project report on **“(Title of Report)”** is prepared by Him/her under the guidance of **(Name of the Guide)**, in partial fulfillment of the requirements for the award of the degree of Master of Business Administration of Visvesvaraya Technological University, Belgaum Karnataka.

Signature of Internal Guide

Signature of HOD

Signature of Principal

DECLARATION

I, **(Student Name)**, hereby declare that the Project report entitled “(Title)” with reference to “(Organisation with place)” prepared by me under the guidance of **(Guide Name)**, faculty of M.B.A Department, **(Institute name)** and external assistance by **(External Guide Name, Designation and Organisation)**. I also declare that this Project work is towards the partial fulfillment of the university Regulations for the award of degree of Master of Business Administration by Visvesvaraya Technological University, Belgaum. I have undergone a summer project for a period of Twelve weeks. I further declare that this Project is based on the original study undertaken by me and has not been submitted for the award of any degree/diploma from any other University / Institution.

Place:
Date:

Signature of the student

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BIBLIOGRAPHY

BOOKS:

1. Name of the Author, Title of the Book, Name of the Publisher, Edition, year of Publication.

ARTICLES:

1. Name of the Author, Title of the article, Name of the Journal, Volume Number, Issue Number, Year, Page Number (pp)

WEBLIOGRAPHY

1. Name of the Author, Title of the article, retrieved on mm/dd/yy, from URL

Visvesvaraya Technological University

Internal Evaluation Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	First Presentation	05
2	Second Presentation	05
3	Third Presentation	10
4	Introduction	05
5	Conceptual background	05

	and literature review	
6	Research design	05
7	Analysis and interpretation	10
8	Summary of findings, suggestions and conclusion	05
	TOTAL	50

Marks Sheet:

SL.No	USN		1	2	3	4	5	6	7	8	Total
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Signature of the Guide with Date

Visvesvaraya Technological University

External Evaluation Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	Introduction & Relevance of the project	10
2	Conceptual background and literature review	05
3	Research design	05
4	Analysis and interpretation	20
5	Summary of findings, suggestions and conclusion	10
	TOTAL	50

SL.No	USN	1	2	3	4	5	Total
1							
2							
3							
4							
5							
6							

7							
8							
9							
10							

Signature of External Examiner with affiliation

Signature of HOD

Visvesvaraya Technological University

Viva-Voce examination Mark Sheet for Project Report

Name of the Institution: _____

Marks Allocation

SL. No	Aspects	Marks
1	Presentation skill	10
2	Communication skills	10
3	Subject knowledge	20
4	Objective of the study or methodology	20
5	Analysis using statistical tools and statistical packages	20
6	Findings and appropriate suggestions	20
	TOTAL	100

SL.No	USN	1	2	3	4	5	6	Total
1								
2								
3								
4								
5								

Signature of External Examiner with affiliation

Signature of HOD

**SCHEME OF TEACHING AND EXAMINATION
MASTER OF BUSINESS ADMINISTRATION**

I SEMESTER

Subject Code	Title of the Subject	Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
			Lecture	Practical / Field Work / Assignment *	Total		IA	Exam		
16MBA11	Management & Organizational Behaviour	Core Course	3	2	5	3	20	80	100	4
16MBA12	Managerial Economics	Core Course	3	2	5	3	20	80	100	4
16MBA13	Accounting for Managers	Core Course	3	2	5	3	20	80	100	4
16MBA14	Quantitative Methods	Core Course	3	2	5	3	20	80	100	4
16MBA15	Marketing Management	Core Course	3	2	5	3	20	80	100	4
16MBA16	Managerial Communications	Core Course	3	2	5	3	20	80	100	4
	Total		18	12	30		120	480	600	24

* Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.

II SEMESTER

Subject Code	Title of the Subject	Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
			Lecture	Practical / Field Work / Assignment *	Total		IA	Exam		
16MBA21	Human Resource Management	Core Course	3	2	5	3	20	80	100	4
16MBA22	Financial Management	Core Course	3	2	5	3	20	80	100	4
16MBA23	Research Methods	Core Course	3	2	5	3	20	80	100	4
16MBA24	Business Law and Policy	Core Course	3	2	5	3	20	80	100	4
16MBA25	Strategic Management	Core Course	3	2	5	3	20	80	100	4
16MBA26	Entrepreneurship Development	Core Course	3	2	5	3	20	80	100	4
	Total		18	12	30		120	480	600	24

* Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.

**III SEMESTER
(Core Specialisation)**

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing	Finance	Human Resource									
16MBAMM301	16MBAFM301	16MBAHR301	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM302	16MBAFM302	16MBAHR302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM303	16MBAFM303	16MBAHR303	Elective	3	2	5	3	20	80	100	3
16MBAMM304	16MBAFM304	16MBAHR304	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM305	16MBAFM305	16MBAHR305	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM306	16MBAFM306	16MBAHR306	Elective	3	2	5	3	20	80	100	3
16MBAIN307			Internship *	0	8	8	-	50	50	100	4
			Industrial Visit	0	0	0	0	0	00	00	0
				18	12	30		120	480	700	22

* Internship will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester. Total number of teaching hours per week is excluding internship workload.

** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.
Industrial visit is a mandatory activity with zero credits

**III SEMESTER
(Core Specialisation Subjects)**

Marketing Specialisation		Finance Specialisation		Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM301	Consumer Behavior	16MBAFM301	Principles & Practices of Banking	16MBAHR301	Industrial Relations & Legislations
16MBAMM302	Retail Management	16MBAFM302	Investment Banking & Financial Services	16MBAHR302	Recruitment & Selection
16MBAMM303	Services Marketing	16MBAFM303	Investment Management	16MBAHR303	Compensation & Benefits
16MBAMM304	Marketing Research	16MBAFM304	Advanced Financial Management	16MBAHR304	Learning & Development
16MBAMM305	Business Marketing	16MBAFM305	Cost Management	16MBAHR305	Knowledge Management
16MBAMM306	Supply Chain Management	16MBAFM306	Strategic Credit Management	16MBAHR306	Conflict & Negotiation Management

III SEMESTER (Dual Specialisation)

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing & Finance	Finance & HR	HR & Marketing									
16MBAMM301	16MBAFM301	16MBAHR301	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM302	16MBAFM302	16MBAHR302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM303	16MBAFM303	16MBAHR303	Elective	3	2	5	3	20	80	100	3
16MBAFM301	16MBAHR301	16MBAMM301	Foundation Course	3	2	5	3	20	80	100	3
16MBAFM302	16MBAHR302	16MBAMM302	Foundation Elective	3	2	5	3	20	80	100	3
16MBAFM303	16MBAHR303	16MBAMM303	Elective	3	2	5	3	20	80	100	3
16MBAIN307			Internship *	0	8	8	---	50	50	100	4
			Industrial Visit	0	0	0	0	00	00	00	0
				18	12	30		120	480	700	22

* Internship will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester. Total number of teaching hours per week is excluding internship workload.

** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.
Industrial visit is a mandatory activity with zero credits

**IV SEMESTER
(Core Specialisation)**

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing	Finance	Human Resource									
16MBAMM401	16MBAFM401	16MBAHR401	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM402	16MBAFM402	16MBAHR402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM403	16MBAFM403	16MBAHR403	Elective	3	2	5	3	20	80	100	3
16MBAMM404	16MBAFM404	16MBAHR404	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM405	16MBAFM405	16MBAHR405	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM406	16MBAFM406	16MBAHR406	Elective	3	2	5	3	20	80	100	3
16MBAPR407			Project Work *	0	8	8	---	50	150	200	12
										800	30

* Project work will be carried out after third semester and shall be evaluated during fourth semester. The internal assessment will be made for 50 marks. In the examination, the total marks of 150 shall be allotted as follows: 50 marks each for report evaluation by internal and external examiners respectively and remaining 50 marks for the viva voce examination, jointly assessed by internal and external examiners.

**** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.**

IV SEMESTER
(Core Specialisation Subjects)

Marketing Specialisation		Financial Specialisation		Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM401	Sales Management	16MBAFM401	Mergers, Acquisitions & Corporate Restructuring	16MBAHR401	Public relations
16MBAMM402	Integrated Marketing Communication	16MBAFM402	Risk Management and Insurance	16MBAHR402	Workplace Ethics & Value Systems
16MBAMM403	E-Marketing	16MBAFM403	Tax Management	16MBAHR403	International Human Resource Management
16MBAMM404	Strategic Brand Management	16MBAFM404	International Financial Management	16MBAHR404	Organisation Change and Development
16MBAMM405	Rural Marketing	16MBAFM405	Financial Derivatives	16MBAHR405	Strategic Talent Management
16MBAMM406	International Marketing Management	16MBAFM406	Corporate Valuation	16MBAHR406	Personal Growth & Interpersonal Effectiveness

IV SEMESTER
(Dual Specialisation)

Subject Code			Category	Teaching hours / week			Duration of Exam (Hours)	Marks for		Total Marks	Credits
				Lecture	Practical / Field Work / Assignment **	Total		IA	Exam		
Marketing & Finance	Finance & HR	HR & Marketing									
16MBAMM401	16MBAFM401	16MBAHR401	Foundation Course	3	2	5	3	20	80	100	3
16MBAMM402	16MBAFM402	16MBAHR402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAMM403	16MBAFM403	16MBAHR403	Elective	3	2	5	3	20	80	100	3
16MBAFM401	16MBAHR401	16MBAMM401	Foundation Course	3	2	5	3	20	80	100	3
16MBAFM402	16MBAHR402	16MBAMM402	Foundation Elective	3	2	5	3	20	80	100	3
16MBAFM403	16MBAHR403	16MBAMM403	Elective	3	2	5	3	20	80	100	3
16MBAPR407			Project Work *	0	8	8	---	50	150	200	12
										800	30

- Project work will be carried out after third semester and shall be evaluated during fourth semester. The internal assessment will be made for 50 marks. In the examination, the total marks of 150 shall be allotted as follows: 50 marks each for report evaluation by internal and external examiners respectively and remaining 50 marks for the viva voce examination, jointly assessed by internal and external examiners.

**** Practical /Field Work / Assignment is a part of contact hours for the faculty and must be considered in the workload.**

**IV SEMESTER
(Dual Specialisation Subjects)**

Marketing & Finance Specialisation		Marketing & Human Resources Specialisation		Finance & Human Resource Specialisation	
Subject Code	Title of the Subject	Subject Code	Title of the Subject	Subject Code	Title of the Subject
16MBAMM401	Sales Management	16MBAMM401	Sales Management	16MBAFM401	Mergers, Acquisitions & Corporate Restructuring
16MBAMM402	Integrated Marketing Communication	16MBAMM402	Integrated Marketing Communication	16MBAFM402	Risk Management and Insurance
16MBAMM403	E-Marketing	16MBAMM403	E-Marketing	16MBAFM403	Tax Management
16MBAFM401	Mergers, Acquisitions & Corporate Restructuring	16MBAHR401	Public relations	16MBAHR401	Public relations
16MBAFM402	Risk Management and Insurance	16MBAHR402	Workplace Ethics & Value Systems	16MBAHR402	Workplace Ethics & Value Systems
16MBAFM403	Tax Management	16MBAHR403	International Human Resource Management	16MBAHR403	International Human Resource Management

Plan of action (proposed)

1. Implementation of CBCS for MBA Programme will be effective from next academic year, i.e., 2016-17
2. Review of Scheme of Teaching and Examinations being finalized
3. Award of Credits for various components of MBA Programme
4. Allotment of marks for the subjects/papers, seminar and summer project.
80:20 patterns of marks for external examination and internal (IA) marks respectively is to be adopted for all the subjects, except Internship, for which the pattern will be 50:50 basis for internal and external assessments respectively.

Question paper for theory examination shall consist of Part A and B as under:

- Part A shall consist of 5 questions subdivided into a, b, c in 3+7+10 mixed pattern
- Part B shall be a *compulsory* question on Case study/ Practical problem for 20 marks (may contain a maximum of 4 sub-questions).

IA Pattern: 20 marks in each subject, comprising of 10 marks for tests and 10 marks for assignments/seminars/practical exercises/quiz/oral exams

MBA Program Structure and Credits			
Year	Particulars	Credits	Total Credits
I	I Semester	24	48
	II Semester	24	
II	III Semester	24	52
	Internship (III Semester)	4	
	IV Semester	18	
	Project Work(IV Semester)	6	
Total		100	100

PROGRAMME OUTCOMES STUDENT WILL BE ABLE CO (POS)

PO1. Acquire Sufficient theoretical knowledge and are enabled to apply them to solve practical problems in business and other organizations / institutions of importance.

PO2. Apply Effective communication skills with a high degree of lateral and critical thinking that enhances learn ability, developed for being continuously employable.

PO3. Demonstrate leadership qualities, ethically sound, enabled with decision making skills that reflect a high degree of social consciousness

PO4. Recognise the need for sustained research orientation to comprehend a growingly complex, economic, legal and ethical environment

PO5. Possess self-sustaining entrepreneurship qualities that encourages calculated risk taking.

SCHEME OF TEACHING AND EXAMINATION

I Semester										
Subject Code	Title of the Subject	Course Category	Teaching hours per week			Duration of Exam hours	Marks for		Total Marks	Credits
			Lecture	Practical Component	Total Hours		CIE	SEE		
18MBA11	Management & Organizational Behavior	Core	4	-	4	3	40	60	100	4
18MBA12	Managerial Economics	Core	4	-	4	3	40	60	100	4
18MBA13	Accounting for Managers	Core	4	-	4	3	40	60	100	4
18MBA14	Business Statistics & Analytics	Core	4	-	4	3	40	60	100	4
18MBA15	Marketing Management	Core	4	-	4	3	40	60	100	4
18MBA16	Managerial Communications	Core	4	-	4	3	40	60	100	4
Total			24	-	24	-	240	360	600	24

Note:

- 1.Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases will be part of the question paper.
- 2.One Industrial Visit per Semester is Mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
3. Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.

II Semester										
Subject Code	Title of the Subject	Course Category	Teaching hours per week			Duration of Examination Hours	Marks for		Total Marks	Credits
			Lecture	Practical Component	Total		CIE	SEE		
18MBA21	Human Resource Management	Core	4	-	4	3	40	60	100	4
18MBA22	Financial Management	Core	4	-	4	3	40	60	100	4
18MBA23	Research Methodology	Core	4	-	4	3	40	60	100	4
18MBA24	Legal and Business Environment	Core	4	-	4	3	40	60	100	4
18MBA25	Strategic Management	Core	4	-	4	3	40	60	100	4
18MBA26	Entrepreneurship Development	Core	4	-	4	3	40	60	100	4
Total			24	-	24	-	240	360	600	24

Note:

- 1.Each course content has indicative case studies which can be dealt in the class by the course instructor. In addition to this the course instructor may use an extra case from Harvard/Case Centre. The student cannot assume the same cases will be part of the question paper.
- 2.One Industrial Visit per Semester is Mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
3. Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.

III Semester (Core Specialization)											
Subject Code			Course Category	Teaching hours per week			Duration of Examination hours	Marks for		Total Marks	Credits
				Lecture	Practical Component	Total		CIE	SEE		
Marketing	Finance	Human Resource									
18MBAMM301 Consumer Behavior	18MBAFM301 Banking and Financial Services	18MBAHR301 Recruitment & Selection	Elective	3	2	5	3	40	60	100	4
18MBAMM302 Retail Management	18MBAFM302 Investment Management	18MBAHR302 HR Analytics	Elective	3	2	5	3	40	60	100	4
18MBAMM303 Services Marketing	18MBAFM303 Direct Taxation	18MBAHR303 Compensation & Reward System	Elective	3	2	5	3	40	60	100	4
18MBAMM304 Marketing Research & Analytics	18MBAFM304 Advanced Financial Management	18MBAHR304 Learning & Development	Elective	3	2	5	3	40	60	100	4
18MBAMM305 Business Marketing	18MBAFM305 Cost Management	18MBAHR305 Industrial Relations & Legislations	Elective	3	2	5	3	40	60	100	4
18MBAMM306 Supply Chain Management	18MBAFM306 Project Appraisal Planning & Control	18MBAHR306 Conflict & Negotiation Management	Elective	3	2	5	3	40	60	100	4
18MBAOS307 Organization Study			Core	0	8	8	--	40	60	100	4
Industrial Visit			Core	--	--	--	--	--	--	--	--
Total				18	20	38	--	280	420	700	28

Note:

1. Each Course has a theory component of 3hrs (3credits) and a Practical component of 2hrs (1credit). The Time-Table allotment for each course should be (3+2) = 5hours.
2. For the practical component, it is mandatory to maintain a practical record.
3. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.
4. Organization Study (Four Weeks) will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester.
5. One Industrial Visit per Semester is Mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
6. Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.

Rubrics for Organization Study				Rubrics for Viva voce Examination	
Particulars		Marks	Aspects		Marks
CIE	Assessment by the Guide- Interaction with the student	20	Communication skill		5
	Report Evaluation by the Guide	20	Understanding the Industry		5
SEE	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/Institute	60	Understanding the Corporate Functions/Company profile		10
	Total	100	Mckensy's 7S framework and Porter's Five Force Model		10
			SWOT analysis		10
			Financial statement analysis		10
			Learning experience		5
			Overall presentation		5
			Total		60

III Semester (Dual Specialization)											
Subject Code			Course Category	Teaching hours per week			Duration of Examination hours	Marks for		Total Marks	Credits
				Lecture	Practical Component	Total		CIE	SEE		
Marketing & Finance	Finance & HR	HR & Marketing									
18MBAMM301 Consumer Behavior	18MBAFM301 Banking and Financial Services	18MBAHR301 Recruitment & Selection	Elective	3	2	5	3	40	60	100	4
18MBAMM302 Retail Management	18MBAFM302 Investment Management	18MBAHR302 HR Analytics	Elective	3	2	5	3	40	60	100	4
18MBAMM303 Services Marketing	18MBAFM303 Direct Taxation	18MBAHR303 Compensation & Reward System	Elective	3	2	5	3	40	60	100	4
18MBAFM301 Banking and Financial Services	18MBAHR301 Recruitment & Selection	18MBAMM301 Consumer Behavior	Elective	3	2	5	3	40	60	100	4
18MBAFM302 Investment Management	18MBAHR302 HR Analytics	18MBAMM302 Retail Management	Elective	3	2	5	3	40	60	100	4
18MBAFM303 Direct Taxation	18MBAHR303 Compensation & Reward System	18MBAMM303 Services Marketing	Elective	3	2	5	3	40	60	100	4
18MBAOS307 Organization study			Core	--	8	8	--	40	60	100	4
Industrial Visit			Core	--	--	--	--	--	--	--	--
Total				18	20	38	-	280	420	700	28

Note:

1. Each Course has a theory component of 3hrs (3credits) and a Practical component of 2hrs (1credit). The Time-Table allotment for each course should be (3+2) = 5hours.
2. For the practical component, it is mandatory to maintain a practical record.
3. 20% of marks should be allocated for application oriented questions in the SEE Question Paper, based on practical component.
4. Organization Study (Four Weeks) will be carried out by students after second semester during vacation and the report submitted by the students will be assessed internally during the third semester.
5. One Industrial Visit per Semester is Mandatory. The Department shall insist on report submission by each student and shall maintain this as a documentary proof. The format of the report shall be prescribed by the department.
6. Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.

Rubrics for Organization Study			Rubrics for Viva voce Examination		
Particulars		Marks	Aspects		Marks
CIE	Assessment by the Guide- Interaction with the student	20	Communication skill		5
	Report Evaluation by the Guide	20	Understanding the Industry		5
SEE	Viva-Voce Examination to be conducted by the Guide and an External examiner from the Industry/Institute	60	Understanding the Corporate Functions/Company profile		10
	Total	100	Mckensy's 7S framework and Porter's Five Force Model		10
			SWOT analysis		10
			Financial statement analysis		10
			Learning experience		5
			Overall presentation		5
			Total		60

IV Semester (Core Specialization)												
Subject Code			Course Category	Teaching hours per week			Duration of Examination hours	Marks for		Total Marks	Credits	
				Lecture	Practical Component	Total		CIE	SEE			
Marketing	Finance	Human Resource										
18MBAMM401 Sales Management	18MBAFM401 Mergers, Acquisitions & Corporate Restructuring	18MBAHR401 Public Relations	Elective	3	--	3	3	40	60	100	3	
18MBAMM402 Integrated Marketing Communication	18MBAFM402 Risk Management and Insurance	18MBAHR402 Organizational Leadership	Elective	3	--	3	3	40	60	100	3	
18MBAMM403 Digital and Social Media Marketing	18MBAFM403 Indirect Taxation	18MBAHR403 International Human Resource Management	Elective	3	--	3	3	40	60	100	3	
18MBAMM404 Strategic Brand Management	18MBAFM404 International Financial Management	18MBAHR404 Organization Change and Development	Elective	3	--	3	3	40	60	100	3	
18MBAMM405 Rural Marketing	18MBAFM405 Financial Derivatives	18MBAHR405 Strategic Talent Management	Elective	3	--	3	3	40	60	100	3	
18MBAMM406 International Marketing Management	18MBAFM406 Corporate Valuation	18MBAHR406 Personal Growth & Interpersonal Effectiveness	Elective	3	--	3	3	40	60	100	3	
18MBAPR407 Project Work			Core	0	12	12	--	40	60	100	6	
Industrial Visit			Core	--	--	--	--	--	--	--	--	
Total				18	12	30	--	280	420	700	24	
Note:												
1.Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.												
2. Project work(Six Weeks) will be carried out after third semester and shall be evaluated during fourth semester.												

IV Semester (Dual Specialization)												
Subject Code			Course Category	Teaching hours per week			Duration of Examination hours	Marks for		Total Marks	Credits	
				Lecture	Practical Component	Total		CIE	SEE			
Marketing & Finance	Finance & HR	HR & Marketing										
18MBAMM401 Sales Management	18MBAFM401 Mergers, Acquisitions & Corporate Restructuring	18MBAHR401 Public Relations	Elective	3	--	3	3	40	60	100	3	
18MBAMM402 Integrated Marketing Communication	18MBAFM402 Risk Management and Insurance	18MBAHR402 Organizational Leadership	Elective	3	--	3	3	40	60	100	3	
18MBAMM403 Digital and Social Media Marketing	18MBAFM403 Indirect Taxation	18MBAHR403 International Human Resource Management	Elective	3	--	3	3	40	60	100	3	
18MBAFM401 Mergers, Acquisitions & Corporate Restructuring	18MBAHR401 Public Relations	18MBAMM401 Sales Management	Elective	3	--	3	3	40	60	100	3	
18MBAFM402 Risk Management and Insurance	18MBAHR402 Organizational Leadership	18MBAMM402 Integrated Marketing Communication	Elective	3	--	3	3	40	60	100	3	
18MBAFM403 Indirect Taxation	18MBAHR403 International Human Resource Management	18MBAMM403 Digital and Social Media Marketing	Elective	3	--	3	3	40	60	100	3	
18MBAPR407 Project Work			Core	--	12	12	--	40	60	100	6	
Industrial Visit			Core	--	--	--	--	--	--	--	--	
Total				18	12	30	-	280	420	700	24	
Note:												
1.Course instructors are free to set the Course outcome and map with the Programme Outcome, subsequently attainment level may be calculated.												
2. Project work(Six Weeks) will be carried out after third semester and shall be evaluated during fourth semester.												

I SEMESTER

MANAGEMENT AND ORGANIGATIONAL BEHAVIOR

Semester	I	CIE Marks	: 40
Course Code	18MBA11	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

COURSE OBJECTIVES:

1. To make students understand fundamental concepts and principles of management, including the basic roles, skills, and functions of management
2. To make students knowledgeable of historical development, theoretical aspects and practice applications of managerial process
3. To understand the basic concepts and theories underlying individual behavior besides developing better insights into one's own self.
4. To make students aware of Individual behavior in groups, dynamics of groups, team building and interpersonal effectiveness besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves

PART A - PRINCIPLES OF MANAGEMENT

Unit 1:

Introduction: Management: Introduction, Definition of management, Nature, Purpose and Functions, Levels and types of managers, managerial roles, skills for managers, evolution of management thought, Fayol's fourteen principles of management, Recent trends in management.

Unit 2:

Planning and Organizing:

Planning: Meaning, Nature of Planning, Planning Process, Objectives, MBO, Strategies, level of strategies, policies, methods and programs, Planning Premises, Decision-making, Process of decision-making, Types of decisions, Techniques in decision-making.

Organizing: Organization structure, Formal and informal organizations, Functional, divisional, geographical, customer based and matrix organizations, team based structures, virtual organizations, boundary less organizations. Principles of organizations-chain of command, span of control, delegation, decentralization, and empowerment.

Case Study: Principles of Management, Cengagelearning, William, Manjunath, Sandhya

Unit 3:

Controlling: Meaning, importance of controlling, controlling process, types of control, factors influencing control effectiveness.

RECOMMENDED BOOKS

- Management and Organizational Behaviors, Chuck Williams, James Cambell, Manjunath & Sandhya Cengage Publications, 2018
- Essentials of Management-Koontz, 8/e, McGraw Hill
- Management: Text and Cases-VSP Rao, Excel Books

REFERENCE BOOKS:

- Masters of Management Thought – Mahanand Charati & M M Munshi, Sapna Book House, Bangalore, 2015.
- Principles and practices of Management, KiranNerkar, Vilas Chopde, Dreamtech Press, 2011
- Management Theory & practice – Chandan J. S, Vikas Publishing House.

PART B - ORGANIZATIONAL BEHAVIOUR

Unit 4:

Introduction: Organizational Behaviour: Introduction, definition, fundamental principles of OB, contributing disciplines, challenges and opportunities. Evolution & Organizational Behavior in India.

Case study: Organizational Behavior by Steven L McShane, Mary Ann Von Glinow and Radha R Sharma, TaTa McGraw Hill companies, Fourth Edition, Pg-6.

Unit 5:

Foundations of Individual Behaviour: Individual behaviour: Foundations of individual behaviour. Ability: Intellectual abilities, Physical ability, the role of disabilities.

Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB.

Perception: Meaning, Process of perception, factors influencing perception, link between perception and individual decision-making.

Attitude: Meaning, Formation, components of attitudes, relation between attitude and behaviour.

Unit 6:

Motivation: Meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories.

Leadership: Meaning, styles of leadership, leadership theories, trait theory, behavioural theories, managerial grid, situational theories.

Case Study: "Nuts and Bolts", Principles of Management, Cengagelearning, William, Manjunath, Sandhya Page no 531-532.

PRACTICAL COMPONENTS:

- Studying organizational structures of any 10 companies and classifying them into different types of organizations which are

studied in Unit 2 and justifying why such structures are chosen by those organizations.

- Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities and behaviors with respects to the trait, behavioural and contingency theories studied.
- Identifying any five job profiles and listing the various types, abilities required for those jobs and also the personality traits/attributes required for the jobs identified.

Note: Faculty can either identify the organizations/ leaders/job profile or students can be allowed to choose the same.

COURSE OUTCOMES:

1. Comprehend & correlate all the management functions which are happening around with fundamental concepts and principles of management.
2. Understand the overview of management, theory of management and practical applications of the same.
3. Effectively use their skills for self-grooming, working in groups and to achieve organizational goals .
4. Demonstrate their acumen in applying managerial and behavioral concept in real world/situation.
5. Understand and demonstrate their exposure on recent trends in management.

RECOMMENDED BOOKS:

- Organizational behaviour, Stephen P Robbins, Timothy A. Judge, Neharika Vohra, 14th Edition, Pearson, 2012.
- Introduction to Organisational Behaviour – Michael Butler, Jaico Publishing House.
- Organizational Behaviour - Anada Das Gupta, Biztantra, 2011.

REFERENCE BOOKS:

- Organizational Behaviour - Fred Luthans, 12/e, McGraw Hill International, 2011.
- Management and Organizational Behaviour - Laurie J Mullins, Pearson education.
- Organizational Behaviour, Aquinas P. G, Excel Books.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X			
CO3			X	X	
CO4					X
CO5			X		

MANAGERIAL ECONOMICS

Semester	I	CIE Marks : 40
Course Code	18MBA12	SEE Marks : 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours : 03
Credits : 04		

Course Objectives:

1. To introduce the fundamentals, tools and theories of managerial economics.
2. To provide an understanding of the application of Economics in Business.
3. To learn the basic economic concepts.
4. To have an understanding of Demand, Production, Cost, Profit and Market competitions with reference to a firm and industry.

Introduction to Economics

Unit 1:

Managerial Economics: Meaning, Nature, Scope, & Significance, Uses of Managerial Economics, Role and Responsibilities of Managerial Economist, Relationship of Managerial Economics with Statistics, Accounting and Operations Research, The Basic process of decision making.

Fundamental Concepts of Managerial Economic

Unit 2:

Opportunity Costs, Incremental Principle, Time perspective, Discounting and Equi-Marginal principles, Theory of the Firm: Firm and Industry, Forms of Ownership, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol’s Model, Marris’s Hypothesis, Williamson’s Model. Behavioral theories: Simon’s Satisficing Model, Cyert and March Model, Agency theory.

Case Study: Dabur India Limited: Growing Big and Global.

Source: Managerial Economics – Geethika, Ghosh & Choudhury, 2/e, McGraw Hill. 2011. Pp 64-65.

Demand analysis

Unit 3:

Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand –Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making, Measurement of elasticity of demand. Law of supply, Elasticity of supply, Demand forecasting: Meaning & Significance, Methods of demand forecasting. (No problems)

Cost Analysis & Production analysis

Unit 4:

Concepts, Types of cost, Cost curves, Cost–Output Relationship in the short run and in the long run, LAC curve. Concepts, production function with one variable input - Law of Variable Proportions. Production function with 2 variable inputs and Laws of returns to scale, Indifference Curves, ISO-Quants & ISO-Cost line, Least cost combination factor, Economies of scale, Diseconomies of scale. Technological progress and production function

Case Study: Automobile Industry in India: New Production paradigm.

Source: Managerial Economics – Geethika, Ghosh & Choudhury, 2/e, McGraw Hill. 2011. Pp 234-236.

Market structure and pricing practices

Unit 5:

Perfect Competition, Features, Determination of price under perfect competition, Monopoly: Features, Pricing under monopoly, Price Discrimination. Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation. Oligopoly: Features, Kinked demand Curve, Cartels, Price leadership.

Descriptive Pricing Approaches: Full cost pricing, Product line pricing, Product life cycle pricing, Pricing Strategies: Price Skimming, Penetration Pricing, Loss leader pricing, Peak Load pricing.

Case Study: David Fights Goliath: The Nirma Story.

Source: Managerial Economics – Geethika, Ghosh & Choudhury, 2/e, McGraw Hill. 2011. Pp 349-351.

Unit 6: Profits

Profits: Determinants of Short-Term & Long Term Profits, Measurement of Profit.

Break Even Analysis – Meaning, Assumptions, Determination of BEA, Limitations, Uses of BEA in Managerial decisions.

PRACTICAL COMPONENTS:

- Assessment of Demand Elasticity – Price, Income, Cross, Advertising.
- Demand Forecasting
- Preparing a Project proposal for a Business Venture.

COURSE OUTCOMES:

1. The student will understand the application of Economic Principles in Management decision making.
2. The student will learn the micro economic concepts and apply them for effective functioning of a Firm and Industry.
3. The Student will be able to understand, assess and forecast Demand.
4. The student will apply the concepts of production and cost for optimization of production.

5. The student will design Competitive strategies like pricing, product differentiation etc. and marketing according to the market structure.
6. The student will be able to identify, assess profits and apply BEP for decision making.

RECOMMENDED BOOKS:

- Managerial Economics – Geethika, Ghosh & Choudhury, 2/e, McGraw Hill. 2011
- Managerial Economics – Dominick Salvatore, 7/e, Oxford Publishers, 2010.
- Managerial Economics – R. Panneerselvam, P. Sivasankaran, P. Senthilkumar, Cengage, 2018.

REFERENCE BOOKS:

- Managerial Economics – Samuelson & Marks, 5/e, Wiley, 2009.
- Managerial Economics – Hirschey, 2/e, Cengage Learning, 2010.
- Managerial Economics: Case Study solutions – Kaushal H, 1/e, Macmillan, 2011.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X			X	
CO3	X				X
CO4					X
CO5				X	
CO6				X	

ACCOUNTING FOR MANAGERS

Semester	I	CIE Marks	: 40
Course Code	18MBA13	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objectives:

1. Explain fundamental accounting concepts, the elements of financial statements, and basic accounting vocabulary.
2. Explain and use the accounting equation in basic financial analysis and explain how the equation is related to the financial statements.
3. Prepare basic entries for business transactions and present the data in an accurate and meaningful manner.
4. Prepare basic financial statements and explain the articulation between the basic statements.
5. To analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.

Unit 1:

Introduction to Accounting: Need and Types of Accounting, Users of Accounting, concepts and conventions of Accounting, Relation of Accounting with other disciplines, Capital and Revenue Expenditure and Receipt, Accounting Equation.

Case study: Problem on Accounting Equation .

Unit 2:

Preparation of books of Accounts: Journals, ledgers 3 column cash book and trial balance, Depreciation- Straight line and Written down Value Methods.

Case Study on Change of Method of Depreciation.

Unit 3:

Preparation of Financial Statements: Preparation of final accounts of sole traders in horizontal form, Preparation of final accounts of companies in vertical form as per Companies Act of 2013 (Basic problems of Final Accounts), Window dressing.

Case Study problem on Final Accounts of Company and Firm.

Unit 4:

Analysis of Financial Statements: Ratio Analysis, Preparation of financial statements using ratios, Preparation of Cash flow Statement (only indirect method).

Case Study on Ratio analysis.

Unit 5:

Emerging issues in Accounting: Human Resource Accounting, Forensic Accounting, Sustainability Reporting. Accounting Standards and IFRS: Nature and significance.

Unit 6:

Fundamentals of Taxation: Basic concepts of Direct & Indirect Tax. Heads of Income, Deductions u/s 80C, Rate of Income Tax of current assessment Year for Individuals only (only theory) .

PRACTICAL COMPONENTS:

- Collecting Annual reports of the companies and analyzing the financial statements using different techniques and presenting the same in the class.
- Analyzing the companies' cash flow statements and presenting the same in the class.
- Exposing the students to usage of accounting software's (Preferably Tally).
- Filling up of ITR forms.
- Identify the sustainability report of a company and study the contents.

COURSE OUTCOME:

1. Demonstrate theoretical knowledge and its application in real time accounting.
2. Demonstrate knowledge regarding accounting principles and its application.
3. Capable of preparing financial statement of sole trading concerns and companies.
4. Independently undertake financial statement analysis and take decisions.
5. Comprehend emerging trends in accounting and taxation.

RECOMMENDED BOOKS:

- Financial Accounting: A Managerial Perspective, Narayanaswamy R, 5/e, PHI, 2014.
- A Text book of Accounting For Management, Maheswari S. N, Maheswari Sharad K. Maheswari, 2/e, Vikas Publishing house (P) Ltd.
- Financial Accounting, Tulsian P. C, 1/e, Pearson Education.

REFERENCE BOOKS:

- Financial Accounting for Management: An Analytical Perspective,

Ambrish Gupta, 4/e, Pearson Education.

- Introduction to Financial Statement Analysis, Ashish K Bhattacharya, Elsevier India.
- Financial Accounting – Raman B. S, Vol I & Vol II, 1/e, United Publishers, 2009.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2	X				
CO3		X			
CO4		X			
CO5				X	X

BUSINESS STATISTICS & ANALYTICS

Semester	I	CIE Marks	: 40
Course Code	18MBA14	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objectives:

1. To make the students learn about the applications of statistical tools and techniques in decision making.
2. To emphasize the need for statistics and decision models in solving business problems.
3. To enhance the knowledge on descriptive and inferential statistics.
4. To familiarize the students with analytical package MS Excel.
5. To develop analytical skills in students in order to comprehend and practice data analysis at different levels.

Unit 1:

Introduction to Statistics: Meaning and Definition, functions, scope and limitations, Collection and presentation of data, frequency distribution, measures of central tendency - Mean, Median, Mode, Geometric mean, Harmonic mean.

Measures of dispersion: Range – Quartile Deviation – Mean Deviation - Standard Deviation – Variance-Coefficient of Variance - Comparison of various measures of Dispersion.

Unit 2:

Correlation and Regression: Scatter Diagram, Karl Pearson correlation, Spearman's Rank correlation(one way table only), simple and multiple regression(problems on simple regression only).

Unit 3:

Probability Distribution: Concept and definition - Rules of probability – Random variables – Concept of probability distribution – Theoretical probability distributions: Binomial, Poisson, Normal and Exponential – Baye's theorem (No derivation) (Problems only on Binomial, Poisson and Normal).

Unit 4:

Time Series Analysis: Introduction - Objectives Of Studying Time Series Analysis - Variations In Time Series - Methods Of Estimating Trend: Freehand Method - Moving Average Method - Semi-Average Method -

Least Square Method. Methods of Estimating Seasonal Index: Method Of Simple Averages - Ratio To Trend Method - Ratio To Moving Average Method.

Unit 5:

Linear Programming: structure, advantages, disadvantages, formulation of LPP, solution using Graphical method. Transportation problem: basic feasible solution using NWCM, LCM, and VAM unbalanced, restricted and maximization problems.

Unit 6:

Project Management: Introduction – Basic difference between PERT & CPM – Network components and precedence relationships – Critical path analysis – Project scheduling – Project time-cost trade off – Resource allocation, Concept of project crashing.

PRACTICAL COMPONENT :(Student-Centered Learning)

- Students are expected to have a basic excel classes.
- Students should be able to relate the concepts which can highly enhance an application scenario in your profession.
- Student should demonstrate the application of the techniques covered in this course.

COURSE OUTCOMES:

1. Facilitate objective solutions in business decision making under subjective conditions.
2. Demonstrate different statistical techniques in business/real-life situations.
3. Understand the importance of probability in decision making.
4. Understand the need and application of analytics.
5. Understand and apply various data analysis functions for business problems.

RECOMMENDED BOOKS:

- Business Statistics and Analytics – Pannerselvam, Nagesh, Senthilkumar, Cengage Learning, 2018.
- BStat: A South Asian Perspective with Course Mate – Keller & Arora Cengage Learning, 2016.
- Quantitative Methods for Business, Anderson, Sweeney and Williams, Thomson, 2005 ISBN 981-240-641-7.

REFERENCE BOOKS:

- Statistical Method s – Dr S. P Gupta, Sulthan Chand & sons, fourth Edition, ISBN 81-8054298-X.
- Fundamentals of Statistics, S.C Gupta, 6th edition, Himalaya Publishing House, 2007, ISBN, 978-81-8318-755-8.
- Analyzing Multivariate Data, James Lattin, Douglas Carroll and Paul Green, Thomson Learning, 2003, ISBN 0-534-34974-9.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X			X	X
CO2		X	X	X	
CO3			X	X	X
CO4				X	
CO5		X			

MARKETING MANAGEMENT

Semester	I	CIE Marks	: 40
Course Code	18MBA15	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objectives:

1. Make students have an understanding of the fundamental concepts of marketing & the environment in which marketing system operates.
2. To analyze the motives influencing buying behaviour & Describe major bases for segment marketing, target marketing, and market positioning.
3. Identify a Conceptual framework, covering basic elements of the marketing mix.
4. To understand fundamental premise underlying market driven strategies.

Unit 1:

Introduction to Marketing: Introduction, Definitions of market and marketing, Selling Vs marketing, The Exchange Process, Elements of Marketing Concept, Functions of Marketing, Old Concept or Product-oriented Concept, New or Modern or Customer-oriented Concept, Marketing Myopia, Marketing Environment analysis, (Micro and Macro), Marketing in the 21st century opportunities, challenges & Ethics.

Unit 2:

Buyer Behavior Analysis: Meaning and Characteristics, Importance, Factors Influencing Consumer Behaviour, Consumer Purchase Decision Process, Buying Roles, Buying Motives. The black box model of consumer behaviour. B2B marketing Vs Consumer Marketing.

Case Study on “ Barista Lavazza”, Marketing Management, Arun Kumar & Meenakshi N, 2/e, Vikas, 2012.Pg 33-34.

Unit 3:

Market Segmentation, Targeting & Positioning (STP): Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Product Differentiation Strategies, Tasks involved in Positioning. Branding - Concept of Branding, Types, Brand Equity, Branding strategies.

Case Study on “ Marketing of Tata’s Nano in India ”, Marketing in India: Text and Cases- Neelamegham S, 4/e, Vikas. Pg 335-354.

Unit 4:

Managing the Product: Concept, product hierarchy, product line, product mix, product mix strategies, Product life cycle and its strategies, New Product Development, packing as a marketing tool, Role of labeling in packing. Services Marketing & its Characteristics.

Case Study on “ American Express ”, Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 14/e, Pearson Education, 2012. Pg 257-259 .

Unit-5:

Pricing decisions: Significance of pricing, factor influencing pricing (Internal factor and External factor), objectives, Pricing Strategies-Value based, Cost based, Market based, Competitor based, Pricing Procedure.

Marketing Channels: Meaning, Purpose, Factors Affecting Channel Choice, Channel Design, Channel Management Decision, Channel Conflict, Designing a physical Distribution System, Network Marketing.

Unit 6:

Promotion Strategy: Integrated Marketing Communications (IMC)-communication objectives, steps in developing effective communication, Stages in designing message. Advertising: Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model, Traditional Vs Modern Media- Online and Mobile Advertising, Social Media for Advertising.

Sales Promotion: Tools and Techniques of sales promotion, Push-pull strategies of promotion. Personal selling: Steps/process involved in Personal Selling. Publicity/Public Relation-word of mouth, sponsorships. Database marketing: Basic concepts of e-commerce, e-marketing, m-Commerce, m-marketing, e-networking, CRM, MkIS.

Marketing Planning: Meaning, Steps involved in Marketing planning. Marketing Audit- Meaning, components of Marketing Audit. Marketing Strategic Planning Process.

Case Study on “ Facebook ”, Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 14/e, Pearson Education, 2012. Pg 503-504.

PRACTICAL COMPONENTS:

- Marketing Games and quiz for Students.
- Analyze Product Life Cycle of few Products like-Electronic goods, Computers etc.
- Study Packaging strategies used by FMCG companies.
- Understand Marketing strategies, plans used by automobile, cosmetic, FMCG companies etc.

COURSE OUTCOME:

1. Develop an ability to assess the impact of the environment on marketing function.
2. To formulate marketing strategies that incorporate psychological and sociological factors which influence buying.
3. Explain how companies identify attractive market segments, differentiate and position their products for maximum competitive advantage in the market place.
4. Build marketing strategies based on product, price, place and promotion objectives.
5. Synthesize ideas into a viable marketing plan.

RECOMMENDED BOOKS

- Marketing Management: A South Asian Perspective–Kotler, Keller, Koshy & Jha, 14/e, Pearson Education, 2012.
- Marketing- Lamb, Hair, Mc Danniel, 7/e, Cengage Learning 2012.
- Marketing Management, Tapan Panda, 2/e, Excel Publication.

REFERENCE BOOKS

- Marketing Management, Arun Kumar & Meenakshi N, 2/e, Vikas, 2012.
- Marketing in India: Text and Cases- Neelamegham S, 4/e, Vikas.
- Fundamentals of Marketing Management, Etzel M.J BJ Walker & William J. Stanton, 14/e, TMH, 2012.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO 3	PO4	PO5
1	X			X	
2		X	X		
3		X			
4					X
5					X

MANAGERIAL COMMUNICATION

Semester	I	CIE Marks	: 40
Course Code	18MBA16	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objective:

1. To enable the students to become aware of their communication skills and sensitize them to their potential to become successful managers.
2. To enable learners with the mechanics of writing and also help them to draft business letters in English precisely and effectively.
3. To introduce the students to some of the practices in managerial communication those are in vogue.
4. To prepare students to develop the art of business communication with emphasis on analysing business situations.
5. To train Students towards drafting business proposals.

Unit 1:

Introduction: Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication – Importance of communication in management – Communication structure in organization – Communication in conflict resolution – Communication in crisis. Communication and negotiation –Communication in a cross-cultural setting.

Unit 2:

Oral Communication: Meaning – Principles of successful oral communication – Barriers to communication – Conversation control –Reflection and Empathy: two sides of effective oral communication. Modes of Oral Communication – Listening as a Communication Skill, Non-verbal communication.

Unit 3:

Written Communication: Purpose of writing – Clarity in writing – Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features – Coherence – Electronic writing process.

Unit 4:

Business Letters and Reports: Introduction to business letters – Types of Business Letters – Writing routine and persuasive letters – Positive and Negative messages Writing Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing

Proposals: Structure & preparation – Writing memos Media Management: The press release – Press conference – Media interviews

Group Communication: Meetings – Planning meetings – objectives – participants – timing – venue of meetings.

Meeting Documentation: Notice, Agenda, and Resolution & Minutes

Unit 5:

Presentation skills: What is a presentation – Elements of presentation – Designing & Delivering Business Presentations – Advanced Visual Support for managers.

Case Methods of learning: Understanding the case method of learning.

Negotiation skills: What is negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies.

Unit 6:

Employment communication: Introduction – Composing Application Messages – Writing CVs – Group discussions – Interview skills
Impact of Technological Advancement on Business Communication – Technology-enabled Communication – Communication networks – Intranet – Internet – E-mails – SMS – teleconferencing – videoconferencing.

Note: Course Instructors are free to set their own cases or use cases from Harvard/Case centre.

PRACTICAL COMPONENTS:

- Make students enact and analyze the non-verbal cues.
- Demonstrating using Communication Equipments like Fax, Telex, Intercoms, etc.
- Demonstrating Video conferencing & teleconferencing in the class.
- Conduct a mock meeting of students in the class identifying an issue of their concern. The students should prepare notice, agenda and minutes of the meeting.
- Each student to give presentation of 5 minutes (this can be spread throughout the semester) and to be evaluated by the faculty.
- Organize a mock press conference addressing to the launch of new product by an organization.
- Students should be given an assignment to draft a proposal to undertake research project.

COURSE OUTCOMES:

1. The students will be aware of their communication skills and know their potential to become successful managers.

2. The students will get enabled with the mechanics of writing and can compose the business letters in English precisely and effectively.
3. The students will be introduced to the managerial communication practices in business those are in vogue.
4. Students will get trained in the art of business communication with emphasis on analysing business situations.
5. Students will get exposure in drafting business proposals to meet the challenges of competitive environment.

RECOMMENDED BOOKS:

- Business Communication: Concepts, Cases And Applications – Chaturvedi P. D, & Mukesh Chaturvedi ,2/e.
- Pearson Education,2011.
- Business Communication: Process and Product – Mary Ellen Guffey, 3/e, Cengage Learning, 2002.
- *Communicating in Business with CourseMate- Ober/Newman-Latest Edition-2018.
- Business Communication – Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010.

REFERENCE BOOKS:

- Effective Technical Communication – Ashraf Rizvi M, TMH, 2005.
- Business Communication – Sehgal M. K & Khetrapal V, Excel Books.
- Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X		X	
CO3		X	X		
CO4					
CO5					X

II SEMESTER HUMAN RESOURCE MANAGEMENT

Semester	II	CIE Marks	: 40
Course Code	18MBA21	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

COURSE OBJECTIVES:

- To understand the HRM concepts and theory.
- To obtain an overview of various HRM functions and practices.
- To gain an insight into the basic statutory provisions.

Unit 1:

Human Resource Management: Introduction, meaning, nature, scope of HRM - Importance and Evolution of the concept of HRM - Major functions of HRM - Principles of HRM.

Case Study on “ Enterprise Builds on People”, Human Resource Management, Angelo S Denis / Ricky W Griffin / Anita Sarkar, Cengage Learning, Page 22-23.

Unit 2:

Job Analysis: Meaning, process of Job Analysis, methods of collecting job analysis data, Job Description and Job Specification, Role Analysis.

Human Resource Planning: Objectives, Importance and process of Human Resource Planning, Effective HRP.

Unit 3:

Recruitment: Definition, Constraints and Challenges, Sources and Methods of Recruitment, Recent trends and Approaches to recruitment.

Selection: Definition and Process of Selection.

Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation.

Case Study on “ Jayram’s Dilemma”, Human Resource Management, Angelo S Denis / Ricky W Griffin / Anita Sarkar, Cengage Learning, Page 123.

Unit 4:

Training and development: Training v/s development, Systematic Approach to Training, Training Methods; one the job and off the job.

Case Study on “ Training Program at ABC Cement”, Human Resource Management, Angelo S Denis / Ricky W Griffin / Anita Sarkar, Cengage Learning, Page 140.

Unit 5:

Performance Appraisal : Concept of Performance Appraisal, the Performance Appraisal Process, Methods of Performance Appraisal.

Employee Turnover & Employee Retention: Meaning, Strategies to manage employee turnover, Employee retention strategies.

Compensation: Meaning of Job Evaluation, Objectives of Compensation Planning, components of compensation, Compensation Pay Structure in India.

Unit 6:

Employee Welfare: Introduction, Types of Welfare Facilities and Statutory Provisions in India.

Employee Grievances: Employee Grievance procedure, Grievances Management in Indian Industry.

Discipline: Meaning, approaches to discipline, essential of a good disciplinary system, managing difficult employees.

PRACTICAL COMPONENTS:

- Give a case and ask the students to prepare the recruitment advertisement for a newspaper.
- Expose students to standard selection tests followed in various sectors.
- Exploring training and development practices.
- Exploring performance appraisal practices in various sectors.
- Exploring employee separation practices.
- Give a job analysis case and ask the students to prepare job description and job specification.
- Ask the students to prepare an appointment letter for the post of office manager of a company known to you.

COURSE OUTCOME:

1. Understanding of HRM functions, principles, Job analysis that facilitates students to design a job description and job specification for various levels of employees.
2. Synthesize knowledge on effectiveness of recruitment process, sources & understanding of systematic selection procedure.
3. Identify the various training methods and design a training program.
4. Understand the concept of performance appraisal process in an organization.
5. List out the regulations governing employee benefit practices.

RECOMMENDED BOOKS:

- Human Resources Management: A South Asian Perspective, Denski/Griffin/Sarkar- Cengage Learning, 2012.
- Human Resource Management – Rao V. S. P, Excel BOOKS, 2010.

- Human Resource Management – Dr. T.P RenukaMurthy HPH.

REFERENCE BOOKS:

- Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.
- Human Resource Management in practice - Srinivas R. Kandula, PHI, 2009
- Managing Human Resources - Luis R Gomez-Mejia, David B. Balkin, Robert L. Cardy,6/e, PHI, 2010.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1		X			
CO2		X			
CO3					X
CO4	X				
CO5			X	X	

FINANCIAL MANAGEMENT

Semester	II	CIE Marks : 40
Course Code	18MBA22	SEE Marks : 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours : 03
Credits : 04		

Course Objectives:

- To familiarize the students with basic concepts of financial management and financial system.
- To understand concept of time value of money and its uses.
- To evaluate the investment proposals.
- To analyze capital structure and dividend decision.
- To understand the management of working capital in an organization.

Unit 1:

Financial management – Introduction to financial management, objectives of financial management. Changing role of finance managers. Interface of Financial Management with other functional areas.

Emerging Issues in financial management: Risk management, Behavioral finance and financial engineering.

Introduction to Financial System. Financial markets, Financial Instruments, Financial institutions and financial services. Introduction to derivatives.

Unit 2:

Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization. (Theory & Problem).

Case Study on Loan amortization.

Unit 3:

Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only).

Cost of Capital: Basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model) - Cost of retained earnings - Determination of Weighted average cost of capital (WACC) and Marginal cost of capital. (Theory & Problem).

Case Study on WACC.

Unit 4:

Investment decisions – Capital budgeting process, Investment evaluation

techniques – Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return (Theory & Problem). Capital rationing; Risk analysis in capital budgeting (Theory only).

Case Study on replacement of capital project.

Unit 5:

Working capital management – factors influencing working capital requirements - Current asset policy and current asset finance policy- Determination of operating cycle and cash cycle - Estimation of working capital requirements of a firm. (Does not include Cash, Inventory & Receivables Management).

Case study on Working Capital Determination.

Unit 6:

Capital structure and dividend decisions – Planning the capital structure. (No capital structure theories to be covered) Leverages, EBIT and EPS analysis. ROI & ROE analysis. Capital structure policy. Dividend policy – Factors affecting the dividend policy - Dividend Policies- Stable Dividend, Stable Payout (No dividend theories to be covered).

Case Study on EBIT-EPS analysis & Leverages.

PRACTICAL COMPONENTS:

- Study the different financial services offered by a bank.
- Identifying the small or medium sized companies and understanding the Investment evaluation techniques used by them.
- Using the annual reports of selected companies, students can study the working capital management employed by them. Students can also compare the working capital management of companies in the same sector.
- Students can choose the companies that have gone for stock split and Bonus issue in the last few years and study the impact of the same on the stock price.

COURSE OUTCOME:

1. Understand the basic financial concepts.
2. Apply time value of money.
3. Evaluate the investment decisions.
4. Analyze the capital structure and dividend decisions.
5. Estimate working capital requirements.

RECOMMENDED BOOKS:

- Financial Management -Prasanna Chandra, 9/e, TMH.
- Financial Management,Khan M. Y.& Jain P. K, 7/e, TMH.

- Financial Management ,I M Pandey, 11th Edition, Vikas Publishing House.

REFERENCE BOOKS:

- Principles of corporate finance, Brealey and Myers, 9/e, TMH.
- Financial Management,Rathod,Babitha Thimmaiah,Harish Babu, HPH.
- Fundamentals of Financial Management,Brigham & Houston, 10/e, Cengage Learning.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X			
CO3			X		
CO4			X	X	
CO5			X		

RESEARCH METHODOLOGY

Semester	II	CIE Marks	: 40
Course Code	18MBA23	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objectives:

1. To understand the basic components of research design.
2. To Gain an insight into the applications of research methods.
3. To equip students with various research analytical tools used in business research.

Unit 1:

Business Research – Meaning, types, process of research- management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Features of good research study.

Case Study 1: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 458.

Unit 2:

Business Research Design: Meaning and significance - Types: Exploratory and Conclusive Research Design.

Exploratory Research: Meaning, purpose, methods- Literature search, experience survey, focus groups and comprehensive case methods.

Conclusive Research Design - Descriptive Research - Meaning, Types – Cross sectional studies and longitudinal studies.

Experimental Research Design – Meaning and classification of experimental designs- formal and informal, Pre experimental design, Quasi-experimental design, True experimental design, statistical experimental design.

Case Study 2: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 455.

Unit 3:

Sampling: Concepts- Types of Sampling - Probability Sampling – simple random sampling, systematic sampling, stratified random sampling, cluster sampling -Non Probability Sampling –convenience sampling- judgemental sampling, snowball sampling- quota sampling - Errors in sampling.

Case Study 3: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 461.

Unit 4:

Data Collection: Primary and Secondary data Primary data collection methods - Observations, survey, Interview and Questionnaire, Qualitative Techniques of data collection, Questionnaire design – Meaning - process of designing questionnaire. Secondary data -Sources – advantages and disadvantages.

Case Study 4: Business Research Methods: S.N.Murthy &U.Bhojanna. Excel Books-page 457.

Measurement and Scaling Techniques: Basic measurement scales- Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert's Scale, Semantic Differential Scale, Thurstone scale, Multi-Dimensional Scaling.

Case Study 5: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 452 & 463.

Unit 5:

Hypothesis - types, characteristics, source, formulation of hypotheses, errors in hypotheses. Parametric and Non-Parametric Tests- t-test, z-test, f-test, u-test, K-W Test (problems on all tests) Statistical analysis- Bivariate and Multivariate Analysis- ANOVA-one-way and two-way classification (theory only).

Case Study 6: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 301.

Unit 6:

Data Analysis and Report Writing: Editing, Coding, Classification, Tabulation, Validation Analysis and Interpretation- Report writing and presentation of results: Importance of report writing, types of research report, report structure, guidelines for effective documentation.

Case Study 7: Business Research Methods: S.N.Murthy & U.Bhojanna. Excel Books-page 470.

PRACTICAL COMPONENTS:

- To identify research problem and collect relevant literatures for data analysis.
- To write the research design by using Exploratory and Descriptive Research methods.
- To prepare the questionnaire on brand awareness, effectiveness of training in public sector organization, Investors attitude towards Mutual funds in any financial institutions.
- To conduct Market survey and to investigate consumer perception towards any FMCG.
- To demonstrate Report writing and Presentation methods.

COURSE OUTCOME:

1. Understand various research approaches, techniques and strategies in the appropriate in business.
2. Apply a range of quantitative / qualitative research techniques to business and day to day management problems.
3. Demonstrate knowledge and understanding of data analysis, interpretation and report writing.
4. Develop necessary critical thinking skills in order to evaluate different research approaches in Business.

RECOMMENDED BOOKS

- Business Research Methods: A South-Asian Perspective with course Mate William G.Zikmund/Barry J.Babin/Jon C.Carr/AtanuAdhikari/Mitch Griffin, Cengage learning.
- Business Research Methods: S.N.Murthy&U.Bhojanna. Excel Books.
- Business Research Methods. Donald R. Cooper & Pamela s Schindler, 9/e, TMH/2007.

REFERENCE BOOKS

- Research Methodology – C.R.Kothari, Vishwa Prakashan.
- Research Methods – M MMunshi& K Gayathri Reddy, Himalaya Publishing House, 2015.
- Marketing Research- Naresh K Malhotrs- 5th Edition, Pearson Education/PHI 2007.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X			
CO3			X		
CO4					X

LEGAL AND BUSINESS ENVIRONMENT

Semester	II	CIE Marks	: 40
Course Code	18MBA24	SEE Marks	: 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours	: 03
Credits : 04			

Course Objectives:

1. To provide insights into the core concepts of incorporation of company.
2. To understand various policies and procedures of the company Act.
3. To gain insights into various procedure of Investigation & Winding up of Companies.

Part-A (Legal Environment)

Unit I:

Indian Contract Act, 1872-Meaning of contract, agreement, essential elements of a valid contract. Law of agency-meaning, creation and termination of agency.

Unit 2 :

Corporate Incorporation and Management

Definition of company, characteristics, types of company, lifting of corporate veil (i) Incorporation of company (ii) Memorandum and Articles of Association (iii) Doctrine of Ultra Vires (iv) Doctrine of Indoor Management and constructive notices Management - (i) Directors: Appointment, Removal, Position, Powers and Duties of Directors. (ii) Auditor and audit Committee: Its Role. Directors – qualification and Appointment, Liabilities and duties.

Mini case Presentation and Discussion on Saloman v/s A Soloman & Company Ltd.

Unit 3:

Oppression, Mismanagement and Investigation:

(i) Prospectus, membership and shareholding in a company.(ii) Prevention of Oppression (iii) Prevention of Mismanagement (iv) Role & Powers of the Company Law Board (v) Role & Powers of Central Government. Meeting : (i) Types of Meetings (ii) Procedure of calling for a meeting (iii) Company's resolutions and its kinds, proxies.

Corporate Liquidation: (i). Winding up of Companies (ii). Mode of winding up of the companies (iii). Compulsory Winding up under the Order of the Tribunal (iv). Voluntary winding up (v). Contributories (vi). Payment of liabilities.

Mini case Presentation and Discussion on Rule in Foss v. Harbottle.

PRACTICAL COMPONENTS:

- Students to collect analyze and discuss MOA, AOA & Prospectus of a company.
- Students to produce a report on the working of reputed agency including its formation, nature of relations with the outside world and such other issues of relevance.

COURSE OUTCOME:

1. Students should get clear idea about the concept of incorporation of company, its relevance, characteristics, types of company, lifting of corporate.
2. Student to acquire knowledge about conducting meeting, duties of directors and Investigation of the company.
3. To give the students an insight on Winding up of the companies , Mode of winding up of the companies.

RECOMMENDED BOOKS:

- Elements of Mercantile law, Sultanchand publications, 34th Edition, 2014
- Legal & Business Environment, Racvindra Kumar & Renukamurthy, Cengage learning, 2018.
- Saleem Sheikh & William Rees, Corporate Governance & Corporate Control, Cavendish Publishing Ltd., 1995.

REFERENCES BOOKS:

- Charles Wild & Stuart Weinstein Smith and Keenan, Company Law, Pearson Longman, 2009
- 2. Institute of Company Secretaries of India, Companies Act 2013, CCH Wolter Kluver Business, 2013.
- Lexis Nexis, Corporate Laws 2013 (Palmtop Edition) 4. C.A. Kamal Garg, Bharat's Corporate and Allied Laws, 2013. Taxmann, Companies Act 2013.

CO – PO MAPPING.

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2			X		X
CO3			X		X

Part-B (Business Environment)

Course Objectives:

1. To provide an understanding about the Macro Economic Environment of Business.
2. To have an understanding of the basic macro-economic concepts.
3. To study the various economic policies of our country.

Unit-4

Indian Business environment: Nature and Scope, Structure of the Business Environment – Internal and External environment. Political and Legal Environment, Economic Environment, Socio – Cultural Environment, Global environment: WTO and global relations.

Basic economic Concepts: Open and Closed Economies, Primary, secondary and Tertiary sectors and their contribution to the economy. SWOT Analysis for the Indian economy. Measuring the Economy: Measuring GDP and GDP Growth rate, Components of GDP, Business Cycle- Features, and Phases.

Unit-5

Industrial Policies and Structure: Planning- Problems in industrial development during the plan period, Classification of industries based on ownership. Industrial policies, Industrial strategy for the future, New Industrial policy 1991.

Structure of Indian Industry: Public and Private Sector Enterprises, Objectives of PSUs, Performance and shortcomings. Private Sector–growth, problems and prospects. SSI – Role in Indian Economy. Startups and their current state in India.Privatisation-Problems and prospects, Disinvestments in Indian public sector Units since 1991.

Case Study : Privatization of Airport and Airline Industry, Source: Business Environment: Text and cases – Justin Paul, 2/e, McGraw Hill. 2008. Pp 166-168.

Unit-6

Economic policies: Fiscal Policy: Objectives, Instruments, Union Budget, Taxes, Role of Government.

Monetary Policy: Money, Measures of money supply, Monetary system in India, Tools for credit control. Structure of the Banking system, RBI and its functions, Banking structure reforms –Narasimham committee recommendations.

India Foreign Trade Policy: Objectives, Features, Policy of 2015-2020-salient features.

PRACTICAL COMPONENTS:

- Students are expected to give a report on how the economic

environment has affected the performance of any five large Indian Business Houses.

- Students are expected to analyze the major economic and financial indicators such as GDP, Inflation, CPI, BSE, NSE, Currency, Gold rate, Oil barrel price etc., for a particular period of time and submit the report on the same.

COURSE OUTCOMES:

1. To student will have an understanding of the macro environment of Business and various macroeconomic concepts.
2. The student will understand the industrial policies of the past and the present and the evolution over time, and how Indian Industrial structure evolved over time.
3. The student will be exposed to various economic policies of the country and the state of economy.

RECOMMENDED BOOKS:

- Economic Environment of Business –Misra S. K &Puri V. K. , 6/e, Himalaya publishing house, 2010.
- Business Environment :Text and Cases - Justin Paul, 3/e, McGrawHill, 2011.
- Business Environment - Fernando, 1/e, Pearson, 2011.

REFERENCE BOOKS:

- Principles of Macro Economics –Mankiw, 4/e, Cengage Learning,2011.
- Macro Economics – Andrew. B. Abel, & Ben S. Bernanke, 7/e,Pearson Education, 2011.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2			X		X
CO3			X		X

STRATEGIC MANAGEMENT

Semester	II	CIE Marks : 40
Course Code	18MBA25	SEE Marks : 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours : 03
Credits : 04		

Course Objectives:

1. To provide insights into the core concepts of strategic management.
2. To evaluate various business strategies in dynamic market environments.
3. To gain insights into various strategic management models.

Unit 1:

Meaning and Nature of Strategic Management, its Importance and relevance and . Characteristics of Strategic Management, The Strategic Management Process. Relationship between a Company ‘ s Strategy and its Business Model.

Minicase Presentation and Discussion: Business model of Amul and KMF , Suggested questions for case presentation: a. Discuss competitive strategy of Amul b. what are the difference between Amul business model and KMF.

Unit 2:

Strategy Formulation- Understand strategic management process business definition & Organization values that build mission statement. Describe strategic vision, mission, goals, long term objectives, short term objectives and discuss their value to the strategic management process. Balanced Score card.

Minicase Presentation and Discussion: Shanghai GM , Suggested questions for case presentation: a. Introducing China’s auto industry, including opportunities & threats b. Why joint venture with SAIC? c. What makes Shanghai GM successful? d. Lessons learnt to other Western MNEs.

Unit 3:

Analyzing a Company’ s External Environment – The Strategically relevant components of a Company’s External Environment – Industry Analysis - what factors are driving industry change and its impact - Porter’s dominant economic feature - Competitive Environment Analysis - Porter’s Five Forces model – Key Success Factors concept and implementation.

Mini-Case Presentations and Discussions: Jet Blue Airlines Suggested topics for case presentation and discussion: a. Analyzing the general (national/global) environment b. Assessing five forces of the industry c. Identifying opportunities & threats of the industry d. Jet Blue’s capability analysis.

Unit 4:

Analyzing a company's resources and competitive position – Analysis of a Company's present strategies - SWOT Analysis – Value Chain Analysis - Benchmarking . Generic Competitive Strategic – Low cost provider Strategy - Differentiation Strategy - Best cost provider Strategy - Focused Strategy - Strategic Alliance and Collaborative Partnerships - Mergers and Acquisition Strategic - Outsourcing Strategic - International Business level.

Minicase presentation and discussion: Wal-Mart Stores Inc. Suggested topics for case presentation and discussion: a. what competitive strategy does the firm use? Why? b. How does the firm achieve competitive advantages via four-building blocks (quality, innovation, efficiency and customer responsiveness)? c. Any evidence or efforts about value-chain activities? d. Recommendations?

Unit:5

Business planning in different environment - Entrepreneurial level Business planning – Multistage wealth creation model for entrepreneurs – Planning for large and diversified companies – brief overview of Innovation, integration, Diversification, Turnaround Strategic – GE nine cell planning grid and BCG matrix.

Minicase Presentation and Discussion: Siemens's Global Development Strategy Suggested topics for presentation and discussion: 1. Why does Siemens need global coordination and integration? 2. How did Siemens coordinate and orchestrate project development and operations dispersed in various regions? 3. Do you think that different foreign subsidiaries should vary in their autonomy and corporate support, why and how? 4. Takeaway lessons and your recommendations.

Unit:6 Strategy Implementation

Organizational design, structures and controls. Importance of integrating strategy implementation and strategy formulation. Organizational structures used to implement different business level strategies. Organizational structures used to implement different corporate level strategy. How corporate culture promotes implementation of strategy, types of control systems.

Minicase presentation and discussion: Infosys Pvt Ltd. Suggested topics for case presentation and discussion: a. Discuss strategy formulation and implementation of recent year.

PRACTICAL COMPONENTS

- Analyzing the Mission and Vision statements of selected Indian companies.
- Applying Michael Porter's model to an industry (Retail, Telecom, Infrastructure, FMCG, Insurance, Banking etc).
- Pick a successful growing company. Do a web-search of all news related to that company over a one-year period.. Analyze the news

items to understand and write down the company's strategy and execution efficiency.

- Pick a company that has performed very badly compared to its competitors. Collect information on why the company failed. What were the issues in strategy and execution that were responsible for the company's failure in the market; Analyze the internal and external factors.
- Map out GE 9-cell matrix and BCG matrix for some companies and compare them.
- Conduct SWOT analysis of companies around your campus.

COURSE OUTCOME:

- Students should get clear idea about the concept of Strategic Management, its relevance, Characteristics, process nature and purpose.
- Student to acquire an understanding of how firms successfully institutionalize a strategy and create an organizational structure for domestic and overseas operations and gain competitive advantage.
- To give the students an insight on strategy at different levels of an organization to gain competitive advantage.
- To help students understand the strategic drive in multinational firms and their decisions in different markets.
- To enable the students to gain knowledge of strategy implementation and the control measures for effective decision-making.

RECOMMENDED BOOKS:

- Crafting and executing Strategy. A Thompson Jr, Margaret A. and John E Gamble. Mc Graw Hill Publication, New Delhi.
- Strategic Management – Hitt & Manikutti, Cengage learning, 2018.
- Strategic Management – Fred R David, PHI Learning Private Ltd, New Delhi.

REFERENCE BOOKS:

- Strategy and the Business Landscape – Pankaj Ghemawat.
- Strategic Management – Competitiveness and Globalization: Michael A. Hitt, Duane Ireland, Robert E. Hokinson, : South Western, Thomson Learning.
- Crafting and Executing Strategy, Arthur Thompson, A.J.Strickland, Arun Jain, Mc Grawhill.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X			
CO3			X	X	
CO4					X
CO5			X		

ENTREPRENEURSHIP DEVELOPMENT

Semester	II	CIE Marks : 40
Course Code	18MBA26	SEE Marks : 60
Teaching Hours / week (L:T:P)	4-0-0	Exam Hours : 03
Credits : 04		

Course Objectives:

1. To develop and strengthen entrepreneurial quality and motivation in students.
2. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.
3. To provide insights to students on entrepreneurship opportunities, sources of funding and institutions supporting entrepreneurs.
4. To understand the contribution of the entrepreneurs towards Rural, Society and Socio Economic Development of the country.

Unit 1:

Entrepreneur & Entrepreneurship: Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneur - Intrapreneur- an emerging class - Concept of Entrepreneurship - Evolution of Entrepreneurship - Development of Entrepreneurship - Entrepreneurial Culture - Stages in entrepreneurial process.

Unit 2:

Business Planning Process: Meaning of business plan - Business plan process - Advantages of business planning - Marketing plan - Production/operations plan - Organization plan - Financial plan - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture.

Unit 3:

Institutions supporting Entrepreneurs: Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - DIC - Single Window - Latest Industrial Policy of Government of India.

Unit 4:

Family Business: Importance of family business - Types - History - Responsibilities and rights of shareholders of a family business - Succession in family business - Pitfalls of the family business - strategies for improving the capability of family business - improving family business performance.

Unit 5:

International Entrepreneurship Opportunities: The nature of international entrepreneurship - Importance of international business to the firm - International versus domestic entrepreneurship - Stages of economic development - Entrepreneurship entry into international business - exporting - Direct foreign investment - barriers to international trade.

Unit 6:

Informal Risk Capital and Venture Capital: Informal risk capital market- venture capital - nature and overview - venture capital process - locating venture capitalists - approaching venture capitalists.

Social Entrepreneurship: Social enterprise-need - types - characteristics and benefits of social enterprises-Social entrepreneurship - Rural entrepreneurship-need and problems of rural entrepreneurship - challenges and opportunities-Role of government. Make in India, Smart India, Digitalized India.

Case studies in Entrepreneurship Development.

PRACTICAL COMPONENTS:

- Make a business plan for your intended business - talk to bankers to find out what they look for in a business plan - modify accordingly and present it in the class.
- Analyze the performance of listed family firms. How is their performance compared to the performance of other firms? Does a family firm successfully manage to create wealth for non-family investors?
- Interview a local entrepreneur to find out his/her major motivations to start a business - which of the skills and characteristics do you find in the entrepreneur?
- Study a local for-profit business and try to list out the positive social impacts of the business.
- Visit a trade show and try to compare the marketing activities of various stalls in that show - make a list of good practices you come across in the show.
- Choose an NGO in your locality. Interview the founder and present the case in class on the motivations - challenges - ecosystem support and their impacts - arrive at possible solutions and convey back to NGO.

COURSE OUTCOMES:

1. Display keen interest and orientation towards entrepreneurship, entrepreneurial opportunities in order to setup a business.
2. As an entrepreneur learn to think creatively and understand the components in developing a Business plan.
3. Become aware about various sources of funding and institutions supporting entrepreneurs.

4. Gain consciousness towards social entrepreneurship and rural entrepreneurship opportunities.

RECOMMENDED BOOKS:

- Entrepreneurship- A South-Asian Perspective, D.F.Kuratko, T.V.Rao – Cengage Learning -2018.
- Entrepreneurship Development-Small Business Enterprise- Poornima Charantimath Pearson Education - 2007.
- Entrepreneurship- Rober D Hisrich - Michael P Peters - Dean A Shepherd - 6/e- The McGraw-Hill companies - 2007.

REFERENCE BOOKS:

- Entrepreneurship Theory at crossroads - Mathew J Manimala - 2/e - Biztantra - 2007.
- Entrepreneurship -Rajiv Roy - 2/e- Oxford University Press 2011.
- Entrepreneurship-Principles and Practices - Kurakto - 7/e- Thomson Publication - 2007.

CO-PO MAPPING

CO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	X				
CO2		X			X
CO3				X	
CO4			X		

MARKETING SPECIALISATION III SEMESTER CONSUMER BEHAVIOR

Semester	III	CIE Marks : 40
Course Code	18MBAMM301	SEE Marks : 60
Teaching Hours / week (L:T:P)	3-0-2	Exam Hours : 03
Credits : 04		

Course Objectives:

1. To understand the concept of consumer behaviour, decision making by consumers, behavioural variables and its influences on consumer behaviour.
2. To comprehend the social and cultural dimensions of consumer behaviour.
3. To provide an insight of the psychological and behavioural concepts of consumers.

Unit 1:

Introduction to the study of Consumer Behaviour: Meaning & Definition of Consumer Behaviour, Difference between Consumer & Customer, Nature & characteristics of Indian Consumers, Consumerism: meaning, Consumer Movement in India, Rights & Responsibilities of consumers in India, Benefits of consumerism.

Unit 2:

Models of Consumer Behaviour: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behaviour, Internal Influences, External Influences.

Consumer Decision Making: Consumer Buying Decision Process, Levels of Consumer Decision Making – Four views of consumer decision making. On-line Decision Making: Meaning & Process/Stages.

Situational Influences- Nature of Situational Influence, Situational Characteristics and consumption behaviour.

Part 1

Unit 3:

Individual Influences on Consumer Behaviour and CRM

A) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals. Motivation Theories and Marketing Strategy - Maslow's Hierarchy of Needs, McGuire's Psychological Motives.

B) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity, Brand Personality, Self and Self-Image.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / FieldWork / Assignment / Tutorials		I.A.	Exam		
14SCN11	Wireless Adhoc Networks	4	2 *	03	50	100	150	4
14SCN12	Advanced in Computer Networks	4	2 *	03	50	100	150	4
14SCN13	Information and Network Security	4	--	03	50	100	150	4
14SCN14	Advanced in Storage Area Network	4	2	03	50	100	150	4
14SCN15x	Elective – I	4	2	03	50	100	150	4
14SCN16	Information and Network Security Laboratory	0	3	03	25	50	75	2
14SCN17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I

14SCN152 Computer Systems Performance Analysis

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH (COMPUTER NETWORK ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14SCN21	Multimedia Communications	4	2 *	03	50	100	150	4
14SCN22	Distributed Computing	4	--	03	50	100	150	4
14SCN23	Network Management	4	2 *	03	50	100	150	4
14SCN24	Switching & Statistical Multiplexing In Telecommunications	4	2	03	50	100	150	4
14SCN25 _x	Elective – II	4	2	03	50	100	150	4
14SSCN26	Distributed Computing Laboratory	0	3	03	25	50	75	2
14SCN27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCN252 Wireless Sensor Networks

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	--	--	-	25	--	25	1
14SCN32	Report on Internship	--	--	-	--	75	75	15
14SCN33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	--	--	3	25	125	150	20

ELECTIVE- III

14SCN422

Service Oriented Architecture

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS	
		Lecture	Fieldwork / Assignment / Tutorials		I.A.	Exam			
14SCN41	Client Server Programming *	4	2 *	03	50	100	150	4	
14SCN42x	Elective-III	4	2	03	50	100	150	4	
14SCN43	Evaluation of Project Phase-II	0	--	--	25	--	25	1	
14SCN44	Evaluation of Project Phase-III	0	--	--	25	--	25	1	
14SCN45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	150	18	
Total		08	07	09	150	400	550	28	
Grand Total (I to IV Sem.)		Marks: 2400; Credits : 94							

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or technical paper.

1).Project Phase – I : 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase – III : Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be $50+50+100=200$ (50 Marks for Internal Guide, 50 Marks for External and 100 for Viva-Voce)

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Course Title: Wireless Ad-hoc Networks	Course Code: 14SCN11
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To explore the design space and conduct trade-off analysis between performance and resources.
- To Determine suitable medium access protocols and radio hardware.
- To learn Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- To explore the Ad-hoc network concepts by using network simulators.

TOPICS

MODULE I

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet;
MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas
 (Chapter 5: 5.1-5.3, Chapter 6: 6.1-6.8) **10 Hours**

MODULE II

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols
 (Chapter 7: 7.1-7.6, 7.8, 7.9) **10 Hours**

MODULE III

Multicast Routing in Ad hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
 (Chapter 8: 8.1-8.7) **10 Hours**

MODULE IV

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad hoc Wireless Networks.
 (Chapter 9: 9.1-9.6, 9.7-9.12) **10 Hours**

MODULE V

Quality of Service and Energy Management in Ad hoc Wireless Networks

Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

(Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6)

10 Hours

LABORATORY WORK

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.
- 2: Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.
4. Develop and Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.
5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

COURSE OUTCOMES

Students will be able to

- Apply knowledge of wireless Ad-hoc networks to various application areas.
- Design, implement and maintain wireless Ad-hoc networks.
- Formulate and solve problems creatively.
- Practical knowledge acquired by hands-on session.

TEXT BOOKS:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

Semester I

Year: 2014-2015

Course Title: Advances in Computer Networks	Course Code: 14SCN12
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To become familiar with the basics of Computer Networks.
- To learn Network architectures.
- To learn Concepts of fundamental protocols.
- To gain the knowledge of internetworking concepts.
- To understand the knowledge of internetworking concepts in various applications.
- To acquire knowledge of implementation concepts in congestion control and error detections.

TOPICS

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1:Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2:Chapter 4

10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2.

10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

T1: Chapter 3.3, 4.1.1, 4.1.3 **T2:** Chapter 13.1 to 13.18, Chapter 18.

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3

10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP).

T1: Chapter 6.4 **T2:** Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8

10 Hours

LABORATORY WORK

PART A: Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

COURSE OUTCOMES

Students will be able to

- Classify network services, protocols and architectures, explain why they are layered.
- Knowledge on key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Practical knowledge gained by hands-on sessions.
- Gain the knowledge of application layer protocol.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier - 2014
2. **T2: Douglas E Comer,** “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Inte rfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill.

Semester I

Year: 2014-2015

Course Title: Information and Network Security	Course Code: 14SCN13
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

TOPICS

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, ..

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer** :SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication

plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

References

1. V k Pachghare: Cryptography and Information Security. PHI Learning. ISBN 978-81-203-3521-9

Semester I

Year: 2014-2015

Course Title: Advances in Storage area Network	Course Code: 14SCN14
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre’s maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems
- To appreciate the use of cables technologies used in SAN technology.

TOPICS

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **10 Hours**

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **10 Hours**

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network;

Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch’s Operating system; Device Drivers; Supporting the switch’s components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Have Knowledge on various RAID levels.
- Apply the techniques used for data maintenance.
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Semester I

Year: 2014-2015

Course Title: Advanced algorithms	Course Code: 14SCN151
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To get an awareness of probabilistic and randomize algorithms.

TOPICS

MODULE I

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

COURSE OUTCOMES:

The students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Get knowledge about different application based algorithm.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Course Title: Computer Systems Performance Analysis	Course Code: 14SCN152
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To understand the concept of planning and design in computer system.

TOPICS

TOPICS:

MODULE I

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

10 Hours

MODULE II

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

10 Hours

MODULE III

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

10 Hours

MODULE IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. **Experimental Design and Analysis: Introduction:** Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

10 Hours

MODULE V

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow

Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Define Little's law and other operational laws
- Apply the operational laws to open and closed systems
- Use discrete-time and continuous-time Markov chains to model real world systems
- Develop analytical techniques for evaluating scheduling policies

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Semester I

Year: 2014-2015

Course Title: Multi-core Architecture and Programming	Course Code: 14SCN153
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multi core architectures
- To expose the students to warehouse-scale and embedded architectures

TOPICS

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

10 Hours

MODULE II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours

MODULE III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours

MODULE IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006.

Semester I

Year: 2014-2015

Course Title: Soft Computing	Course Code: 14SCN154
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

Topics:

MODULE I

Introduction to Soft computing, Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model. **10 Hours**

MODULE II

Perceptron Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propogation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models) **10 Hours**

MODULE III

Introduction to classical sets and fuzzy sets, Classical relations and fuzzy relations, Membership functions, **10 Hours**

MODULE IV

Defuzzification, Fuzzy decision making, and applications **10 Hours**

MODULE V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA
General genetic algorithms, The schema theorem, Genetic programming, applications

10 Hours

Course Outcomes:

The student will be able to:

- Implement machine learning through neural networks.

- Write Genetic Algorithm to solve the optimization problem
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.

Text book:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, Jun-2007
(Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

Reference Books:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, PHI (EEE edition) ISBN: 978-81-203-2243-1

Semester I

Year: 2014-2015

Course Title: Information and Network security Lab	Course Code: 14SCN16
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives:

- To understand the fundamentals of Cryptography through practical implementation.
- To implement standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to use cutting edge simulation tools
- To design security applications in the field of Information technology.

LABORATORY WORK

Note: Use C/C++/Java or equivalent tool to implement the following experiment

1. Consider a file with composite data, substitute the content and transpose the ciphers.
2. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
3. Apply the RSA algorithm on a text file to produce cipher text file.
4. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
5. Implementation of Message Authentication Code using cryptography VMAC function.
6. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output
7. Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN [Subnetting].
8. Develop a mechanism to setup(configure) a port scanner and identify the intrusion.

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Semester II

Year: 2014-2015

Course Title: Multimedia Communications	Course Code: 14SCN21
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

Course Objectives:

- To understand the Multimedia Communication Models
- To study the Multimedia Transport in Wireless Networks
- To solve the Security issues in multimedia networks
- To explore real-time multimedia network applications.
- To explore different network layer based application.

TOPICS

MODULE I

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework. **10 Hours**

MODULE II

Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards. **10 Hours**

MODULE III

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access. **10 Hours**

MODULE IV

Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution. **10 Hours**

MODULE V

Network Layer: Introduction, QoS in Network Multimedia Systems. **10 Hours**

LABORATORY WORK

The following experiments should be practiced (Tools such as HTML/Frontpage/Dreamweaver/ equivalent, Multimedia application enabling software ,System software support for multimedia, Performance measurement tools for multimedia ,Multimedia authoring tools, Web tools and applications)

1. Audio and video editing
2. Image editing
3. 2D and 3D animation.

.The case studies are:

- Video on-demand
- Interactive TV
- Home shopping
- Remote home care
- Electronic album
- Personalized electronic journals.

COURSE OUTCOMES:

Students will be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network applications.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

Semester II

Year:2014-2015

Course Title: Distributed Computing	Course Code: 14SCN22
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To learn Basic Concepts of DSM, Hardware DSM
- To understand File Sharing, DFS Implementation, Replication in DFS,
- To understand the concepts of Cryptanalysis, Secure channels, Access control.
- To understand some of the security concepts in distributed computing.

TOPICS

MODULE I

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

10 hours

MODULE II

Distributed Shared Memory :Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

10 hours

MODULE III

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies. **Naming**: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

10 hours

MODULE IV

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies.

10 hours

MODULE V

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS. **Emerging Trends in distributed Computing**: Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

10 hours

COURSE OUTCOMES:

The student will be able to

- Realize shared memory concept.
- Realize Advantages of DFS.
- Implement mechanisms to manage security in DS

Text Book.

1. Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010

Semester II

Year:2014-2015

Course Title: Network Management	Course Code: 14SCN23
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the need for interoperable network management.
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP and TMN.
- To understand network management as a typical distributed application

TOPICS

MODULE I

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

10 Hours

MODULE II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

10 Hours

MODULE III

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model
SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.

10 Hours

MODULE IV

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

10 Hours

MODULE V

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation

Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **10 Hours**

LABORATORY WORK:

1. Capture packets transferred while browsing a selected website (e.g. a page from the course website, a search engine home page). Investigate the protocols used in each packet, the values of the header fields and the packet sizes.
2. Explore at least the following features of Wireshark: filters, Flow Graphs (TCP), statistics, protocol hierarchies.
3. Create several example files for your Apache web server to serve. Configure your web server, and then ask a friend to test your web server by accessing the files. Capture the packets and observe the log file.
4. Configure authentication for a specific directory on your web server. Test, captured packets and observe the log file.
5. Login to another computer in the lab, capture and investigate the data exchanged.
6. Trace the path between several pairs of source/destination nodes.
7. Create fire wall rule(s) that will drop TCP packets destined to a specific computer on the lab network (e.g. yours neighbors computer).
8. Using the supplied client/server sockets programs, implement a third proxy server.

Note: NS2 or equivalent tool to be used.

Course Outcomes:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Semester II

Year:2014-2015

Course Title: Switching & Statistical Multiplexing in Telecommunications	Course Code: 14SCN24
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand Switching and multiplexing.
- To understand the transmission technology.
- To understand the transmission control.
- To understand basic knowledge on telecommunication.

Topics:

MODULE I

Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. **Why Digital:** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

10 Hours

MODULE II

Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

10 Hours

MODULE III

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. **Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

10 Hours

MODULE IV

Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

10 Hours

MODULE V

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

10 Hours

Course Outcomes:

The student will be able to:

- Gain the knowledge about switching and multiplexing
- Gain the knowledge about telecommunication.
- Learn transmission control in telecommunication.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Semester II

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCN251
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To gain knowledge Virtualization
- To gain knowledge Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- To gain knowledge in cloud resource virtualization and scheduling.

TOPICS:

MODULE I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

MODULE II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

MODULE III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study:Xen a VMM based

paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

MODULE IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

MODULE V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

Course Outcomes:

The student will be able to:

- Demonstrate simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Semester II

Year:2014-2015

Course Title: Wireless Sensor Networks	Course Code: 14SCN252
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.

- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

TOPICS:

MODULE I

Introduction, Overview and Applications of Wireless Sensor Networks

Introduction, Basic overview of the Technology, **Applications of Wireless Sensor Networks:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology

(Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)

10 Hours

MODULE II

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, **Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Available Wireless Technologies

(Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)

10 Hours

MODULE III

MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **Routing Protocols for Wireless Sensor Networks:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

(Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)

10 Hours

MODULE IV

Transport Control and Middleware for Wireless Sensor Networks

Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. **Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

(Chapter 7: 7.1-7.4, Chapter 8: 8.1-8.4)

10 Hours

MODULE V

Network Management and Operating System for Wireless Sensor Networks

Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. **Operating Systems for Wireless Sensor Networks:** Introduction, Operating System Design Issues, Examples of Operating Systems.

(Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)

10 Hours

COURSE OUTCOMES

The student will be able to:

- Develop applications of wireless sensor actuator networks
- Implement the elements of distributed computing and network protocol .

- Explore various hardware, software platforms that exist for sensor networks

TEXT BOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications”, WILEY , Second Edition (Indian) , 2014

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.

Semester II

Year: 2014-2015

Course Title: Optical Networks	Course Code: 14SCN253
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM
- To acquire knowledge about fault and congestion management.

Topics

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours

MODULE II

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCh-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum Load **Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Design a system, component or process as per needs and specification.
- Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
- Gain the knowledge on methodologies of optical network design optimization;
- Explore techniques of optical network survivability.
- Solve the Problems in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advances in VLSI Design and Algorithms	Course Code: 14SCN254
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- Able to understand the fundamentals of CMOS VLSI and associated technologies.
- Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
- Able to appreciate the design process in VLSI, GALS.
- Able to explain basic operation principles of diodes and MOS FPGAs; PLA.
- Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout

TOPICS:**MODULE I**

Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing; Integrated Circuit Design Techniques; IP-Based Design.

Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

10 Hours**MODULE II**

Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

10 Hours**MODULE III**

Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

10 Hours**MODULE IV**

Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

10 Hours**MODULE V**

Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

10 Hours

Course Outcomes:

The student will be able to:

- Clear understanding of important concepts in CMOS technology and fabrication that affect design.
- Apply two-level and multi-level logic minimization techniques to the given Boolean logic function.
- Design and develop Layout a gate in CMOS VLSI technology.

TEXT BOOKS:

1. Wayne Wolf: “Modern VLSI design”, 4th Edition, P HI Learning, 2007.
2. Sabih H Gerez: “Algorithms for VLSI Design Autom ation”, Wiley India, 2007.

Semester II

Year: 2014-2015

Course Title: Distributed Computing Lab	Course Code: 14SCN26
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives

- To understand the main ideas and concepts on web services.
- Studying and working on a related topic of internet applications such as information hiding, system security and E-learning.
- To understand the concepts of UDDI, SOAP, JMS remote procedure calls.

LIST OF EXPERIMENTS:

Note: Use appropriate tools/language to implement the following experiment:

1. Design and implement client server application using RMI (Remote Method Invocation) to invoke a service to calculate the income tax.
2. Design and implement EJB (Entity Java Beans) session bean business logic to calculate income tax and invoke the service using stub, i.e., client side proxy object.
3. Design and implement an EJB entity bean to persist the client submitted data into an enterprise information system.
4. Design and implement an offline database communication system using JMS (Java Message Service) to service the client request.
5. Design and implement the client code to call the Micro soft service like free service from UDDI (Universal Description Discovery Protocol).
6. Design and implement business logic and bind it as service using SOAP (Simple Object Access Protocol), also implement client to call service.

NOTE: Use EJB 3.X or any equivalent tool.

COURSE OUTCOMES:

The student will be able to

- Develop and debug RPC based client-Server programs in UNIX.
- Realize the partial implementation of UDDI, SOAP, JMS in Web applications.

Semester IV

Year: 2014-2015

Course Title: Client-Server Programming	Course Code: 14SCN41
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand **Client-Server software**, Context Switching and Protocol Software, I/o.
- To understand System Calls, Basic I/O Functions available in UNIX
- To understand the Socket interface, TCP, UDP in detail.
- Various client software applications and their issues.
- To understand the concept of Socket interface in client server programming.

TOPICS:

MODULE I

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts
Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP. **10 Hours**

MODULE II

The Socket Interface: Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **10 Hours**

MODULE III

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays,

A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

MODULE IV

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

MODULE V

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

LABORATORY WORK:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Design, develop, and execute a program using JAVA networking facilities to implement a simple Day / Time Server and demonstrate its functioning. Repeat the above problems.

COURSE OUTCOMES

The student will be able to:

- Gain in depth knowledge about Client-Server software, Context Switching and Protocol Software, I/o.
- Programming System Calls, Basic I/O Functions available in UNIX
- Gain the knowledge on Socket interface, TCP, UDP in details.
- Pros and cons of Client Software Various applications and their issues.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Title: Analysis of Computer Networks	Course Code: 14SCN421
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To Become familiar with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- To analyze network architectures in stochastic and deterministic way.
- RSVP, Principles of TCP
- To explore more on different network protocols.
- To understand the knowledge of multiplexing, streaming sessions in computer network.

TOPICS:**MODULE I**

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

10 Hours**MODULE II**

Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

10 Hours**MODULE III**

Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

10 Hours**MODULE IV**

Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

10 Hours**MODULE V**

Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

10 Hours**Course Outcomes:**

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

Semester IV

Year:2014-2015

Course Title: Service Oriented Architecture	Course Code: 14SCN422
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand various architecture for application development
- To understand the importance of SOA in Application Integration
- To learn web service and SOA related tools.
- To learn the concepts of SOA governance.

Topics:

MODULE I

SOA BASICS: Software Architecture – Types of IT Architecture – S OA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architec ture – Enterprise Applications – Solution Architect ure for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models

10 Hours

MODULE II

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Ac tivity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits o f SPA – Cost Savings

10 Hours

MODULE III

SOA GOVERNANCE :SOA implementation and Governance – strategy – SOA d evelopment – SOA governance – trends in SOA – event-driven architect ure – software s a service – SOA technologies – pro of-of-concept – process orchestration – SOA best practice s

10 Hours

MODULE IV

SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL, SOAP and Java/XML mapping in SOA – JAXB Data binding.

10 Hours

MODULE V

APPLICATION INTEGRATION: JAX-WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study – WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Compare the different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Text Book:

1. Shankar Kambhampaly, “Service-Oriented Architecture for Enterprise Applications”, Wiley 2008.

REFERENCES:

2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.
3. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009.

Semester IV

Year: 2014-2015

Course Title: Mobile Application Development	Course Code: 14SCN423
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To Understand system requirements for mobile applications
- To Generate suitable design using specific mobile development frameworks
- To Generate mobile application design
- To Implement the design using specific mobile development frameworks
- To acquire knowledge of android applications development.

Topics:

MODULE I

Introduction to mobile communication and computing:, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover

and security. Smart phone operating systems and smart phones applications.

10 Hours

MODULE II

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control .

10 Hours

MODULE III

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

10 Hours

MODULE IV

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations,

10 Hours

MODULE V

Displaying web pages and maps, communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications.

10 Hours

Course Outcomes:

The student will be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop and design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS

Text Books:

1. Mobile Computing: Technologies and Applications- N. N. Jani S chand,2009.
2. B.M.Hirwani- Android programming Pearson publications-2013

Course Title: Cybercrime and Digital Forensic	Course Code: 14SCN424
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To understand Accounting Forensics
- To analyze the nature and effect of cyber crime in society.
- To understand Sarbanes-Oxley Financial and Accounting Disclosure Information
- To understand Computer Crime and Criminals
- To understand Liturgical Procedures

Topics:**MODULE I**

INTRODUCTION: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

10 Hours**MODULE II**

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

10 Hours**MODULE III**

INVESTIGATION: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

10 Hours**MODULE IV**

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. **10 Hours**

MODULE V

LAWS AND ACTS: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

10 Hours

Course Outcomes

The student will be able to:

- Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.
- Distinguish various types of computer crime, and use computer forensic techniques to identify the digital fingerprints associated with criminal activities.
- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- Develop a custom computer forensic analysis tool.

Text:

1. Nelson Phillips and Einfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw -Hill , New Delhi, 2006.

References:

3. Robert M Slade,” Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

I Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work/ Assignment/ Tutorials		I.A.	Exam	
12SCN11	Advanced Digital Communication	4	2#	3	50	100	150
12SCN12	Computer Networks	4	2*	3	50	100	150
12SCN13	Network Programming	4	2*	3	50	100	150
12SCN14	Information Security	4	2#	3	50	100	150
12SCN15x	Elective – I	4	2	3	50	100	150
12SCN16	Seminar	--	3	--	50	--	50
Total		20	13	15	300	500	800

Elective I

12SCN151 C# and .Net

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

II Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam	
12SCN21	Wireless & Mobile Networks	4	2*	3	50	100	150
12SCN22	Client-Server Programming	4	2*	3	50	100	150
12SCN23	Optical Networks	4	2#	3	50	100	150
12SCN24	Switching & Statistical Multiplexing in Telecommunications	4	2#	3	50	100	150
12SCN25	Elective – II	4	2	3	50	100	150
	**Project Phase-I(6 Week						
12SCN26	Seminar	--	3	--	50	--	50
Total		20	13	15	300	500	800

Elective – II

12SCN254 Cloud Computing

** Between the II Semester and III Semester after availing a vocation of 2 weeks.

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

III Semester

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam	
12SCN31	Network Management	04	--	03	50	100	150
12SCN32x	Elective – III	04	02	03	50	100	150
12SCN33x	Elective – IV	04	02	03	50	100	150
12SCN34	Project Phase - II		§				
12SCN35	Evaluation of Project Phase-I	–	03	–	50	–	50
Total		12	07	09	200	300	500

Elective – III

12SCN321 Protocols Engineering

Elective – IV

12SCN331 Wireless Sensor Networks

§ 3 Days Course work and 3 days for Project work

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

IV Semester

Course Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
12SCN41	Evaluation of Project Phase – II	-	-	-	50	-	50
12SCN42	Evaluation of Project work – III	-	-	-	50	-	50
12SCN43	Project work evaluation and Viva-voce	-	-	03	-	100+100	200
	Total	-	-	03	100	200	300
Grand Total (I to IV Sem.) : 2400							

Note: Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

Note:

* Lab Classes for any two core subjects are compulsory (practical will be evaluated for 20 marks and internal assessment for 30 marks. Lab journals should be maintained).

For the remaining two core subjects, it can be field work, assignment, tutorials.

- 1) Project Phase – I : 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation. Evaluation of the same shall be taken up during beginning of III Semester. Total Marks shall be 50. Colleges have to send the synopsis after Phase – I.
- 2) Project Phase – II: 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 50.
- 3) Project Phase– III: 24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. Total Marks shall be 50. At the end of the Semester Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 50 + 50 + 100 = 200 (50 marks for guide, 50 marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

The Marks of Project Phase – I shall be sent to the University along with III Semester I.A. Marks of other subjects.

The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.

- 4) During the final viva, students have to submit all the reports.
- 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).

ADVANCED DIGITAL COMMUNICATION

Subject Code: 12SCN11

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Digital Transmission Fundamentals: Digital Representation of Information: Block-Oriented Information, Stream Information; Why Digital Communications? Comparison of Analog and Digital Transmission, Basic properties of Digital Transmission Systems; Digital Representation of Analog Signals: Bandwidth of Analog Signals, Sampling of an Analog Signal, Digital Transmission of Analog Signals; Characterization of Communication

Channels: Frequency Domain Characterization, Time Domain Characterization;

Fundamental Limits in Digital Transmission: The Nyquist Signaling Rate, The Shannon Channel Capacity; Line Coding; Modems and Digital Modulation: Binary Phase Modulation, QAM and Signal Constellations, Telephone Modem Standards; Properties of Media and Digital Transmission Systems: Twisted Pair, Coaxial Cable, Optical Fiber, Radio Transmission, Infrared Light; Error Detection and Correction: Error Detection, Two Dimensional Parity Checks, Internet Checksum, Polynomial Codes, Standardized Polynomial Codes, Error Detecting Capability of a Polynomial Code.

2. Brief Review of digital communication systems: Elements of Digital communication systems; Communication channels and their characteristics; Historical perspective in the development of digital communication; Review of the features of a decreases memory less channel and the channel capacity theorem

3. Wave form Coding Techniques: PCM, Channel. Noise and error probability, DPCM, DM, coding speech at low bit rates, Applications.

4. Base band Shaping for data transmission: Discrete PAM signals, Inter-symbol interference (ISI) Nyquist criterion for distortion-less Base band binary transmission, correlative coding, Eye-pattern, transmission, correlative coding, Eye-patterns Based and M-ary PAM system, Adaptive Equalization, The zero forcing algorithm, The LMA algorithm

TEXT BOOKS:

1. Alberto Leon – Garcia and Indra Widjaja: Communication Networks – Fundamental Concepts and Key architectures, 2nd Edition, Tata McGrawHill, 2006.
2. Simon Haykin: Digital Communication, Wiley India, 2007.

REFERENCE BOOKS:

1. John G Proakis: Digital Communications, 3rd Edition, McGraw Hill, 2008.
2. Leon W Couch: Analog / Digital Communication, 5th Edition, PHI, 2008.

COMPUTER NETWORKS

Subject Code: 12SCN12

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Review of Basic Concepts: Building a Network; Requirements- Connectivity, Cost-Effective Resource Sharing, Support for Common Services; Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture; Performance- Bandwidth and Latency, Delay× Bandwidth Product, High-Speed Networks.

2. Direct link networks: Hardware Building Blocks-nodes, links; error Detection- Two-Dimensional Parity, Internet checksum Algorithm, cyclic Redundancy Check; reliable Transmission- Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Rings (802.5, FDDI) –Token Ring Media Access Control, Token Ring Maintenance, FDDI.

3. Packet Switching: Switching and forwarding – Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches – Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges; cell switching (ATM) – Cells, Segmentation and Reassembly, Virtual Paths, Physical Layers for ATM.

4. Internetworking: Simple internetworking (IP) – What Is an Internetwork?, Service Model, Global Address, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels; Routing – Network as a Graph, distance Vector(RIP), Link State(OSPF), Metrics, Routing for Mobile Hosts, Global Internet – Subnetting, Classless Routing(CIDR), Interdomain Routing(BGP), Routing Areas, IP Version 6(IPv6).

5. End –to-End Protocols: Simple demultiplexer (UDP); Reliable byte stream (TCP) – End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Alternative Design Choices.

6. Congestion Control and Resource Allocation: Issues in resource allocation – Network Model, Taxonomy, Evaluation Criteria; Queuing discipline – FIFO, Fair Queuing; TCP Congestion Control – Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion-Avoidance mechanisms – DECbit, Random Early Detection (RED), Source-Based Congestion Control.

7. Applications: Traditional applications – Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Name Service (DNS), Network management (SNMP); Web services – Custom APPLICATION Protocols (WSDL, SOAP), A Generic application Protocol (REST).

Laboratory Work:

Using any Protocol Analyzer like Ethereal, perform the following experiments:

1. Capture the packets that are transmitted after clicking on the URL of the web site of your college. Analyze the packets at the highest level and prepare a brief report of your analysis.
2. Analyze the data captured above at lower levels and demonstrate the layering of the protocols.
3. Capture the packets in the LAN, & filter for a unique subscriber
4. Capture the ARP packets and find the MAC addresses in the LAN in your laboratory.

Using either NS228/OPNET or any other suitable simulator, perform the following experiments:

1. Simulate an Ethernet LAN using 10 node , change error rate and data rate , and compare throughput
2. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Implement the following in C/C++:

1. Write a program for distance vector algorithm to find suitable path for transmission.
2. Write a program for error detecting code using CRC-CCITT (16-bit)
3. Write a program for congestion control using leaky bucket algorithm.

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks –Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

NETWORK PROGRAMMING

Subject Code: 12SCN13

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Review of Basic Concepts:** Layering, OSI model, Processes, A simplified model, Client-Server model, A history of Unix Networking; Review of TCP/IP.
- 2. Sockets:** Introduction, Unix domain protocols, socket addresses, elementary socket system calls, advanced socket system calls, reserved ports, stream pipes, passing file descriptions, socket options, asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, sockets and signals, Internet superservers, socket implementation.
- 3. TFTP Protocol:** Introduction, protocol, security, data formats, connections, client user interface, UDP implementation, TCP implementation.
- 4. Remote Command Execution:** Introduction, Security issues, rcmd function and rshd server, rexec function and rexecd server.
- 5. Remote Login:** Introduction, Terminal line disciplines, pseudo terminal, terminal modes, control terminals rlogin overview, rlogin client, rlogin server.
- 6. JAVA Network Programming:** Introduction, Client-Server Computing, The InetAddress class, Serving multiple clients, Applet clients, Sending and receiving objects, Retrieving objects from Web servers, Datagram sockets.

TEXT BOOKS:

1. W. Richard Stevens: Unix Network Programming, PHI, 2001.
2. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson, 2007.

REFERENCE BOOKS:

1. W. Richard Stevens: TCP/IP Illustrated, Volumes 1, 2, and 3, Pearson, 2000.

Laboratory Work:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple echo server and demonstrate its working. Both the server and client are to be connection-oriented and use TCP. The system works as follows: Client reads a line from the standard input and writes the line to the server; the server reads a line from its network input and echoes the line back to the client; the client reads the echoed line and prints it on its standard output.
2. Repeat the above experiment using UDP instead of TCP.
3. Repeat the Experiment 1 using JAVA network programming facilities.
4. Modify the above program such that the client sends an integer value supposed to represent the radius of a circle and the server is to compute and return the corresponding area.
5. Extend the above program such that the server responds to multiple clients.

Mini Project: Design, develop, and execute a program in C under UNIX / LINUX environment to implement any utility in TCP/IP suite like PING, TFTP etc.

Information Security

Subject Code: 12SCN14

IA Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction to Information Security: Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.

2. Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.

3. Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections. Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.

4. Information Security maintenance: Introduction; Security Management Models; The Maintenance Model.

5. Introduction to Network Security: Attacks, Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs; Wireless network security.

6. Cryptography: Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.

7. Authentication Applications: Kerberos, X.509 Directory Authentication Service.

8. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

9. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.

10. Web Security: Web security requirements, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET).

11. Software: Introduction; Software flaws; Malware; Software-based attacks; Digital Rights Management;

TEXT BOOKS:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.
2. William Stallings: Network Security Essentials Applications and Standards, Person, 2000.
3. Deven N. Shah: Information Security – Principles and Practice, Wiley India, 2009.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Cryptography and Network Security, Tata McGraw-Hill, 2007.

Elective I

12SCN151 C# and .Net

12SCN152 Stochastic Models and Applications

12SCN153 System Modeling and Simulation

12SCN154 Embedded Systems

C# and .Net

Subject Code: 12SCN151

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. The Philosophy of .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the.NET Base Class Libraries, What C# Brings to the Table, An Overview of.NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the.NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

2. Building C# Applications: The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class

3. C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases),Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining

Custom Namespaces.

4. Object- Oriented Programming with C#: Forms defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#’s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#’s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C #’s Polymorphic Support, Casting Between

5. Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System, Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application- Level Exception (System. System Exception), Handling Multiple Exception, the Family Block, the Last Chance Exception. Dynamically Identifying Application and System Level Exception Debugging System Exception Using VS.NET, Understanding Object

Lifetime, the CIT of “new’, The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

6. Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator(IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (IComparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type). Callback Interfaces, Delegates, and Events, Advanced Techniques Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example,

Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer. Using C# Indexer

from VB.NET. Overloading operators, The Internal Representation of Overloading Operators,

interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom, Conversion Routines, Defining Implicit Conversion Routines, The Internal\Representations of Customs Conversion Routines

7. Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#, Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly ,Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details),Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly.

TEXT BOOKS:

1. Andrew Troelsen: Programming C# with .NET 3.0, 4th Edition, Wiley India, 2009.
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. Tom Archer: Inside C#, WP Publishers, 2001.
2. Herbert Schildt: C# - The Complete Reference, Tata McGraw Hill, 2004.

STOCHASTIC MODELS AND APPLICATIONS

Subject Code: 12SCN152

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: A Speech Recognition System, A Radar System, A Communication Network.

2. Introduction to Probability Theory: Experiments, Sample Spaces, and Events, Axioms of Probability, Assigning Probabilities, Joint and Conditional Probabilities, Bayes's Theorem, independence, Discrete random Variables, Engineering Application: An Optimal Communication System

3. Random variables, Distributions, and Density Functions: The Cumulative Distribution Function, The Probability Density Function, The Gaussian Random Variable, Other Important Random Variables, Conditional Distribution and Density Functions, Engineering Application: Reliability and Failure Rates

4. Random Processes: Definition and Classification of Processes, Mathematical Tools for Studying Random Processes, Stationary and Ergodic Random Processes, Properties of the Autocorrelation Function, Gaussian random Processes, Poisson Processes, Engineering Application: Shot Noise in a p-n Junction Diode

5. Markov Processes: Definition and Examples of Markov Processes, Calculating Transition and State Probabilities in Markov Chains, Characterization of Markov Chains, Continuous Time Markov Processes, Engineering Application: A Telephone Exchange

6. Poisson Processes, Queuing Theory: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times. Queuing Theory: Introduction; Preliminaries; Exponential models; Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

7. Simulation Techniques: Computer Generation of Random Variables, Generation of Random Processes, Simulation of Rare Events, Engineering Application: Simulation of a Coded Digital Communication System.

TEXT BOOKS:

1. Scott L. Miller, Donald G. Childers: Probability and Random Processes With Applications to Signal Processing and Communications, Elsevier, 2004.
2. Sheldon M. Ross: Probability Models for Computer Science, Elsevier, 2002.

REFERENCE BOOKS:

1. R. W. Wolff: "Stochastic Modeling and Queuing Theory", Prentice Hall, 1989.
2. B. R. Bhat: "Stochastic Models Analysis and Applications", New Age International, 2000.

SYSTEM MODELING AND SIMULATION

Subject Code: 12SCN153

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Some recent applications of Simulation; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

2. General Principles: Concepts in Discrete-Event Simulation, List processing.

3. Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

4. Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

5. Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers

Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

6. Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

7. Verification, Calibration, and Validation of Simulation Models: Model building, verification, and validation; Verification of simulation models; Calibration and validation of

models. Optimization via Simulation

8. Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

9. Case Study: Simulation of networked computer systems.

TEXT BOOKS:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.

REFERENCE BOOKS:

1. Lawrence M. Leemis, Stephen K. Park: "Discrete – Event Simulation: A First Course", Pearson Education, 2006.
2. Averill M. "Law: Simulation Modeling and Analysis", 4th Edition", Tata McGraw-Hill, 2007.

EMBEDDED SYSTEMS

Subject Code : 12SCN154

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

- 1. Custom single-purpose processor design;** RT level custom single-purpose processor design, optimizing custom single-purpose processors: Optimizing the original program, optimizing the FSM, Optimizing the data path, optimizing the FSM.
- 2. Timers, counters, and watchdog timers. State machine models:** introduction; An introductory example, A basic state machine model: finite-state machines(FSM);finite-state machines with data path model (FSMD);using state machines: Describing a system as a state machine, Comparing state machine and sequential program models, Capturing a state machine model in a sequential programming language; hierarchical/concurrent state machine model (HCFSM) and the state charts language; program state machine model(PSM);The role of an appropriate model and language.
- 3. Concurrent process models: concurrent processes:** process create and terminate ,process suspend and resume, Process join; Communication among processes: shared memory, Message passing; synchronization among processes: Condition variables, monitors. Interrupts: interrupt Basics; The Shared Data Problem; interrupt latency
- 4. Survey of Software Architecture:** Round Robin, Round Robin with interrupts, Function queue scheduling architecture, Real time operating system architecture, selecting architecture. Introduction to RTOS: Tasks and task states, tasks and Data, semaphores and shared data.
- 5. Operating systems services:** Message queues, mailboxes, and pipes; Timer functions; Events; memory management, Interrupt routines in an RTOS environment. Basic design using an RTOS; Overview, principles, an example, encapsulating semaphores and queues, Hard Real-time scheduling considerations, saving power.

6. **Embedded software development tools:** Host and target machines; Linker/locator for Embedded software, getting embedded software into the target system. Debugging Techniques: Testing on host machine, instruction set simulators, macros and tools.
7. **An example system:** what the program does, environment in which the program operates.

Text Books:

1. Embedded system design : A unified Hardware/software introduction – Frank Vahid, Tony Givargis, John Wiley and Sons, Inc. 2002 (Articles : 2.4, 2.5, 2.6; 4.2, 8.3 to 8.13)
2. An Embedded software Primer – David E. Simon; Pearson Education, 1999. (Chapters: 4, 5, 6, 7, 8, 9, 10 and 11)

Reference books:

1. Embedded C: Michael J. Pont, Pearson Education (2002)
2. Real-Time systems and programming languages : Alan Burns and Andy Wellings, Addison Wesley-Longman (1997)
3. Real Time programming: A guide to 32 bit embedded development, Grehan, Moore and Cyliax, Addison-Wesley-longman.

WIRELESS & MOBILE NETWORKS

Subject Code: 12SCN21

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems

2. Wireless Communications Modern Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

3. The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations, Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference

4. Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.

5. Modulation Techniques for Mobile Radio: Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).

6. Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple

Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols, Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems

7. Wireless Networking: Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

Laboratory Work:

1. Using any package like MATLAB or using any programming language of your choice, implement the BPSK algorithm and study its performance.
2. Repeat the above experiment for QPSK algorithm and compare its performance with that of BPSK.
3. Using any Network simulation package or using any programming language of your choice, implement and study the performance of PRMA.

Mini Project: Using any platform like ANDROID, J2ME etc, implement any mobile application like Location Based Services, Emergency Services, Remote Monitoring etc.

TEXT BOOKS:

1. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2nd Edition, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. William C Y Lee: Mobile Communications Engineering Theory and Applications, 2nd Edition, McGraw Hill Telecommunications 1998.
2. William Stallings: Wireless Communications and Networks, Pearson Education Asia, 2002.

CLIENT-SERVER PROGRAMMING

Subject Code: 12SCN22

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. The Client Server Model and Software Design:** Introduction, Motivation, Terminology and Concepts
- 2. Concurrent Processing in Client-Server software:** Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O.
- 3. Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.
- 4. The Socket Interface:** Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters.
- 5. Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using

UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

6. Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

7. Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

8. Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server.

9. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

10. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes

Laboratory Work:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Repeat the above problems using JAVA networking facilities.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001.

OPTICAL NETWORKS

Subject Code: 12SCN23

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Three generations of Digital Transport Networks; A brief introduction to WDM and TDM; The Optical Marketplace; Wireless Optical Systems; Key Optical Nodes; Other Key Terms; Evolution of Optical Systems; Key attributes of Optical Fiber.

2. Telecommunications Infrastructure: The Local Connections; The Backbone Connections; The Digital Multiplexing Hierarchy; The Digital Signaling Hierarchies; T1 / DS1 and T3 / DS3; The Layered Protocol Model in the Transport Network; considerations for Interworking Layer1, Layer 2, and Layer 3 Networks.

3. Characteristics of Optical Fiber: The Basics; The Wavelength; The Basic Components; Structure of the Fiber; Fiber Types; Key Performance Properties of Fiber; Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion; Lasers.

4. Timing and Synchronization: Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and DS1; Timing Downstream Devices; Building Integrated Timing Supply; Synchronization Status Messages and Timing Loops.

5. SONET and SDH: Introduction; The SONET Multiplexing Hierarchy; SONET and SDH Multiplexing Structure; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; Virtual Tributaries in more detail; Virtual Tributaries in Virtual Containers; The Overhead Bytes; SONET and SDH Concatenation.

6. Architecture of Optical Transport Networks: The Digital Wrapper; Control Planes; In-Band and Out-Band Control Signaling; Importance of Multiplexing and Multiplexing Hierarchies; Current Digital Transport Hierarchy; SONET Multiplexing Hierarchy; SDH

Multiplexing Hierarchy; Key Indexes and Other Terms; The New Optical Transport and Digital Transport Hierarchy; The OTN Layered Model; Encapsulation and Decapsulation Operations; Generic Framing Procedure

7. WDM: The WDM Operation; DWDM, TDM and WDM Topologies; Relationship of WDM to SONET / SDH; EDF; WDM Amplifiers; Add-Drop Multiplexers; WDM Cross-Connects; Wavelength Continuity Property; Examples of DWDM Wavelength Plan; Higher Dispersion for DWDM; Tunable DWDM Lasers.

8. Network Topologies and Protection Schemes: The Non-Negotiable Requirement Robust Networks; Diversity in the Network; Line and Path Protection Switching; Types of Topologies; Working and Protection Fibers; Point-to-Point Topology; BLSR; Protection Switching on Four-Fiber BLSR; Meshed Topologies; PONs; Ethernet in the Wide Area Backbone? Metro Optical Networking

9. MPLS and Optical Networks: Label Switching; FEC; Types of MPLS Nodes; Label Distribution and Binding; Label Switching and Traffic Forwarding; MPLS Support of VPNs; MPLS Traffic Engineering; Multiprotocol Lambda Switching; MPLS and Optical TE Similarities; Possibilities for the MPIS Network; Control and Data Planes Interworking

10. Architecture of IP and MPLS-Based OTNs: IP, MPLS, and Optical Control Planes; Interworking the three Control Planes; Management of the Planes; A Framework for the IP over Optical Networks; An Opposing View; Generalized MPLS use in Optical Networks; Bi-Directional LSPs in Optical Networks; GMPLS Extensions for G.709; GMPLS with SONET and SDH.

11. The Link Management Protocol: Keep the Optical Link up and running; What is managed? Data-bearing Links; Clarification of terms; Basic functions of LMP; Control Channel Management; Link Property Correlation; Fault Management; Extending LMP operations for Optical Link Systems.

12. Optical Routers: Optical Switching; Implementation Preferences; Key Terms;

Evolution of Switching Networks; Optical Router; Optical Switching Technologies; Optical Resources; Protecting the Label Switched Paths; Protection of the OSP; Wavelength OSP and MPLS LSP; Nesting the LSPs and OSPs; Topologies for a Node Failure; Plane Coupling 31

and De-Coupling; Some End-to-End Wavelengths and Node-to-Node Wavelengths; Granularity of Labels versus Wavelength Support; Approach to the Problem of LSP and OSP Interworking; MEMS and Optical Switching; Thermo-Optic Switches.

13. ASON Operation at the UNI and NNI: Objectives of ASON; UNI and NNI; Managing the Optical Bandwidth in the ASON; General approach to Optical Bandwidth Management; IETF Optical Carrier Framework for the UNI; Types of Connections; NNI; UNI and NNI Signaling Services.

14. ATM versus IP in Optical Internets: IP over ATM over SONET; The OSI and Internet Layered Models; ATM in the SONET / SDH Payload Envelope; PPP in the SONET Payload Envelope; Encapsulation / Framing Rules; The PPP Packet; The ATM versus IP; Overhead of IP and ATM; Three encapsulation methods

15. Evolving to 3G Architecture: Migration of IP Optical Networking; IP and the Optical Backbones; Placing MPLS into the Picture; Putting it together.

TEXT BOOKS:

1. Uyles Black: Optical Networks, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. Rajiv Ramaswami and Kumar N.Sivaranjan: Optical Networks - A Practical Perspective, Morgan Kaufmann, 2000.
2. Paul E.Green Jr.: Fiber Optic Network, Prentice Hall, 1993.
3. Jeff Hecht: Understanding Fiber Optics, 4th Edition, PHI 1999.

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS

Subject Code: 12SCN24

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks
- 2. Why Digital?** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.
- 3. Switching:** Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization
- 4. Electronic Space Division Switching:** Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks.
- 5. Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vcoders, Pulse Transmission, Line Coding, Time Division Multiplexing.
- 6. Time Division Switching:** Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.
- 7. Traffic Engineering:** Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Elective – II

12SCN251	Distributed systems
12SCN252	Computer Systems Performance Analysis
12SCN253	Web Engineering
12SCN254	Cloud Computing
12SCN255	Web Commerce

DISTRIBUTED SYSTEMS

Subject Code: 12SCN251

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Characterization of Distributed Systems and System Models:** Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges, Architectural models, Fundamental models.
- 2. Networking and Internetworking:** Types of Networks, Networks principles, Internet protocols
- 3. Interprocess Communication:** Introduction, The API for the Internet protocols, External data representation and marshalling, Client -Server communication, Group communication, Case study: Interprocess communication in UNIX
- 4. Distributed Objects and Remote Invocation:** Communication between distributed objects, Remote procedure call, events and notifications
- 5. Operating System Support and Security:** The Operating system layer, protection, processes and threads, communication and invocation, operating system architecture
- 6. Transactions and Concurrency Control:** Transactions, nested transactions, locks, Optimistic concurrency control, timestamp ordering, comparison of methods for concurrency control.
- 7. Distributed Shared Memory:** Design and Implementation issues, sequential consistency and lvy.

TEXT BOOKS:

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems, Concept and Design, 3rd Edition, Pearson Education, 2005.

REFERENCE BOOKS:

1. Sukumar Ghosh: Distributed Systems, An Algorithmic Approach, Chapman & Hall / CRC, 2007.
2. Pradeep K. Sinha: Distributed Operating Systems, Concepts and Design, PHI, 2007.
3. Randy Chow, Theodore Johnson: Distributed Operating Systems and Algorithm Analysis, Pearson, 2009.

COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Subject Code: 12SCN252

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: The art of Performance Evaluation; Common mistakes in Performance Evaluation; A systematic approach to Performance Evaluation; Selecting an evaluation technique; Selecting performance metrics; Commonly used performance metrics; Utility classification of performance metrics; Setting performance requirements.

2. Workloads, Workload Selection and Characterization: Types of workloads: addition instructions; Instruction mixes; Kernels; Synthetic programs; Application benchmarks; Popular benchmarks. Work load selection: Services exercised; Level of detail; Representativeness; Timeliness; Other considerations in workload selection.

Work load characterization techniques: Terminology; Averaging; Specifying dispersion; Single-parameter histograms; Multi-parameter histograms; Principle-component analysis; Markov models; Clustering.

3. Monitors, Program Execution Monitors, and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors; Software versus hardware monitors; Firmware and hybrid monitors; Distributed system monitors. Program execution monitors and accounting logs: Program execution monitors; Techniques for improving program performance; Accounting logs; Analysis and interpretation of accounting log data; Using accounting logs to answer commonly asked questions.

4. Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in capacity planning; Common mistakes in benchmarking; Benchmarking games; Load drivers; Remote-terminal emulation; Components of an RTE; Limitations of RTEs

5. Experimental Design and Analysis: Introduction: Terminology; Common mistakes in experiments; Types of experimental designs. 2k Factorial Designs: Concepts; Computation of effects; Sign table method for computing effects; Allocation of variance; General 2k

Factorial Designs. General full factorial designs with k factors: Model; Analysis of a general design; Informal methods.

6. Queuing Models: Introduction: Queuing notation; Rules for all Queues; Little's law; Types of stochastic processes. Analysis of Single Queue: Birth-Death processes; M / M / 1 Queue; M / M / m Queue; M / M / m / B Queue with finite buffers; Results for other M / M / 1 Queuing Systems.

Queuing Networks: Open and closed Queuing Networks; Product form networks;

Queuing Network models of Computer Systems. Operational Laws: Utilization law; Forced flow law; Little's law; General response time law; Interactive response time law; Bottleneck analysis. Mean Value analysis and related techniques: Analysis of open queuing networks; Mean value analysis; Approximate MVA; Balanced job bounds.

Convolution Algorithm: Distribution of jobs in a system; Convolution algorithm for computing G(N); Computing performance using G(N); Timesharing systems. Hierarchical decomposition of Large Queuing Networks: Load-dependent service centers; Hierarchical decomposition; Limitations of Queuing Theory.

TEXT BOOKS:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2007.

REFERENCE BOOKS:

1. Paul J. Fortier, Howard E. Michel: Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.
2. Trivedi, KS: Probability and Statistics with Reliability, Queuing and computer science Applications, 2nd Edition, Wiley India, 2001.

WEB ENGINEERING

Subject Code: 12SCN253

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Motivation, Categories of web applications, Characteristics of web applications.
- 2. Requirements Engineering:** Introduction, Fundamentals, RE specifics in web engineering, Principles of RE for web applications, Adapting RE methods to web application development, Outlook.
- 3. Modeling Web Application:** Introduction, Fundamentals, Modeling specifics in web engineering, Modeling requirements, Content modeling, Hypertext modeling, Presentation modeling, Customization modeling, Methods and tools, Outlook.
- 4. Web Application Architectures:** Introduction, Fundamentals, Specifics of web application architectures, Components of a generic web application architecture, Layered architectures, Data-aspect architectures.
- 5. Technology-Aware Web Application Design:** Introduction, Web design from an evolutionary perspective, Presentation design, Interaction design, Functional design, Outlook.
- 6. Technologies for Web Applications:** Introduction, Fundamentals, Client/Server communication on the web, Client side technologies, Document-specific technologies, Server-side technologies, Outlook.
- 7. Testing Web Applications:** Introduction, Fundamentals, Testing specifics in web engineering, Test approaches, Test scheme, Test methods and techniques, Test automation, Outlook.
- 8. Operation and Maintenance of Web Applications:** Introduction, Challenges following the launch of a web application, Content management, Usage analysis, Outlook.

- 9. Web Project Management:** From software project management to web project management, Challenges in web project management, Managing web teams, Managing the development process of a web application, Outlook.
- 10. The Web Application Development Process:** Motivation, Fundamentals, Requirements for a web application development process, Analysis of the rational unified process, Analysis of extreme programming, Outlook.
- 11. Usability of Web Applications:** Motivation, What is usability? What characterizes the usability of web applications? Design guidelines, Web usability engineering methods, Web usability engineering trends, Outlook.
- 12. Performance of Web Applications:** Introduction, What is performance? What characterizes performance of web applications, System definition and indicators, Characterizing the work load, Analytical techniques, Representing and interpreting results, Performance optimization methods, Outlook.
- 13. Security for web Applications:** Introduction, Aspects of security, Encryption, digital signatures, and certificates, Secure Client/Server interaction, Client security issues, Service provider security issues, Outlook.
- 14. The Semantic Web:** Fundamentals of the semantic web, Technological concepts, Specifics of semantic web applications, Tools, Outlook.

Text Book:

1. Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzgeer (Editors): Web Engineering, Wiley India, 2007.

Reference Books:

1. Roger Pressman, David Lowe: Web Engineering: A Practitioner's Approach, McGraw Hill, 2008.

CLOUD COMPUTING

Subject Code: 12SCN254

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
- 2. Cloud models:** Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public versus private clouds, cloud infrastructure self service.
- 3. Cloud at a service:** Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand.
- 4. Cloud solutions:** Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.
- 5. Cloud offerings:** Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud.
- 6. Cloud management:** Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.
- 7. Cloud virtualization technology:** Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center.
- 8. Cloud and SOA:** SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

TEXT BOOKS:

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011.

Reference Books

1. Michael Miller, Cloud Computing: Web based applications that change the way you work and collaborate online, Que publishing , August 2009.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On Demand computing applications and data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

WEB-COMMERCE

Subject Code: 12SCN255

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. E-commerce in Indian business context:** Definition of e-commerce advantages of e-commerce, disadvantages of e-commerce, e-commerce opportunities for industries, e-transition challenges for Indian corporate.
- 2. Business models for e-commerce:** e-business models based on relationship of transaction parties – B2C, B2B, C2C and C2B; e-business models based on relationship of transaction types – Brokerage model, Aggregator model, Info-mediary model, community model, value chain model, advertising model, subscription model.
- 3. Enabling Technologies of www :** Internet client-server applications, Networks and Internets, IPV4, IPV6, Search Engines, software agents, Internet standards and specifications, ISP, Broadband technologies – types of broadband technology.
- 4. E-marketing:** Traditional marketing, identifying web-presence goods, Browsing behavior model, online marketing, e-advertising, e-branding, Marketing strategies.
- 5. E-payment Systems:** Main concerns in Internet banking, Digital payment, requirements, Digital token based e-payment systems, classification of new payment systems, Properties of e-cash, cheque payment on Internet, Risk of e-payment systems, Designing e-payment systems, digital signatures.
- 6. Other issues:** E-CRM solutions; e-supply chain management – strategic advantage, ESCM components; Information and Strategy – The virtual value chain, seven dimensions of e-commerce strategy.

Text Books

1. P.T. Joseph, S.J. *“E Commerce – and Indian perspective”* – Third edition, PHI 2010. Ch. 1,2,3,4,6 and related sections of 7,8 and 9 only.
2. Ravi Kalakota and Andrew Winston *“Frontiers of E-commerce”* 12th edition, Pearson Education, 2004.

NETWORK MANAGEMENT

Subject Code: 12SCN31

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards-Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.
- 2. Basic Foundations: Standards, Models, and Language:** Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model
- 3. SNMPv1 Network Management:** Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

- 4. SNMP Management – RMON:** Remote Monitoring, RMON SMI and MIB, RMON1-RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.
- 5 . Broadband Network Management:** Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.
- 6. Network Management Applications:** Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Elective – III

12SCN321	Protocols Engineering
12SCN332	Advances in Digital image processing
12SCN323	Advances in Storage Area Networks

PROTOCOLS ENGINEERING

Subject Code: 12SCN321

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases
- 2. Error Control, Flow Control:** Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance
- 3. Network Reference Model:** Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.
- 4. Protocol Specification:** Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.
- 5. Protocol Specification Language (SDL):** Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP Multi Protocol Label Switching SDL components.
- 6. Protocol Verification / Validation:** Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL

Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol

Validation: ABP Validation.

7. Protocol Conformance and Performance Testing: Conformance Testing

Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing Multimedia Systems, quality of service test architecture(QOS), Performance Test methods, SDL Based Performance Testing of TCP, OSPF, Interoperability testing, Scalability testing protocol synthesis problem

8. Protocol Synthesis and Implementation: Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis, Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS.

TEXT BOOKS:

1. Pallapa Venkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.

REFERENCE BOOKS:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

TOPICS IN MULTIMEDIA COMMUNICATIONS

Subject Code: 12SCN322

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

- 1. Introduction to Multimedia Communications:** Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework.
- 2. Framework for Multimedia Standardization:** Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards.
- 3. Application Layer:** Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.
- 4. Middleware Layer:** Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.
- 5. Network Layer:** Introduction, QoS in Network Multimedia Systems.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.
3. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Volume 1-Media Coding and Content Processing, 2nd Edition, Pearson, 2003.
4. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

ADVANCES IN STORAGE AREA NETWORKS

Subject Code: 12SCN323

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access.

2. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

3. I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

4. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

5. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

6. Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

7. SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

8. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

9. Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2007.

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
2. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2003.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006

Elective – IV

12SCN331	Wireless Sensor Networks
12SCN332	Advances in Digital image processing
12SCN333	Topics in Analysis of Computer Networks

WIRELESS SENSOR NETWORKS

Subject Code: 12SCN331

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Unique Constraints and Challenges, Advantages of Sensor Networks, Energy advantage, Detection advantage, Sensor Network Applications, Habitat monitoring, Wildlife conservation through autonomous, non-intrusive sensing, Tracking chemical plumes, Ad hoc, just-in-time deployment mitigating disasters, Smart transportation: networked sensors making roads safer and less congested, Collaborative Processing.

2. Key Definitions and The Problem: Key Definitions of Sensor Networks, Canonical Problem: Localization and Tracking, Tracking Scenario, Problem Formulation, Sensing model, Collaborative localization, Bayesian state estimation, Distributed Representation and Inference of States, Impact of choice of representation, Design desiderata in distributed tracking, Tracking Multiple Objects, State space decomposition, Data association, Sensor Models, Performance Comparison and Metrics.

3. Networking and Protocols: Networking Sensors, Key Assumptions, Medium Access Control, The SMAC Protocol, IEEE 802.15.4 Standard and ZigBee, General Issues, Geographic, Energy-Aware Routing, Unicast Geographic Routing, Routing on a Curve, Energy-Minimizing Broadcast, Energy-Aware Routing to a Region, Attribute-Based Routing, Directed Diffusion, Rumor Routing, Geographic Hash Tables. Infrastructure Establishment, Topology Control, Clustering, Time Synchronization, Clocks and Communication Delays, Interval Methods, Broadcasts, Localization and Localization Services, Ranging Techniques, Range-Based Localization Algorithms, Other Localization Algorithms, Location Services. Sensor Tasking and Control, Task-Driven Sensing, Roles of Sensor Nodes and Utilities, Information-Based Sensor Tasking, Sensor selection, IDSQ: Information-driven sensor querying, Cluster leader based protocol, Sensor tasking in tracking relations, Joint Routing and Information Aggregation, Moving center of

aggregation, Multi-step information-directed routing, Sensor group management, Case study: Sensing global phenomena.

4. Databases: Sensor Network Databases, Sensor Database Challenges, Querying The Physical Environment, Query Interfaces, Cougar sensor database and abstract data types, Probabilistic queries, High-level Database Organization, In- Network Aggregation, Query propagation and aggregation, Tiny DB query processing, Query processing scheduling and optimization, Data-Centric Storage, Data Indices and Range Queries, One-dimensional indices, Multidimensional indices for orthogonal range searching, Non-orthogonal range searching, Distributed Hierarchical Aggregation, Multi-resolution, Partitioning, Fractional cascading, Locality preserving hashing, Temporal Data, Data aging, Indexing motion data.

5. Platforms and Tools: Sensor Network Platforms and Tools, Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms, Operating system: Tiny OS, Imperative language: nesC, Dataflow style language: Tiny GALS, Node-Level Simulators, ns-2 and its sensor network extensions, TOSSIM, Programming Beyond Individual Nodes: State-centric programming, Collaboration groups, PIECES: A state-centric design framework, Multi-target tracking problem revisited. Applications and Future Directions.

TEXT BOOKS:

1. Feng Zhao, Leonidas Guibas: Wireless Sensor Networks – An Information Processing Approach, Elsevier, 2004.

ADVANCES IN DIGITAL IMAGE PROCESSING

Subject Code: 12SCN332

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

2. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

3. Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial

4. Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency- Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.

5. Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.

6. Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color

Segmentation, Noise in Color Images, Color Image Compression.

7. Image Transformation: Discrete Cosine Transforms, Walsh Hadmard Transforms, Wavelet Transforms and Multiprocessing, Background, Multiresolution Expansions, Wavelet Transforms in one Dimension, Wavelet Transforms in Two Dimensions, Wavelet Packets, an overview of Second Generation Wavelet Transforms.

8. Image and Video Compression: Fundamentals, Image Compression Models, Lossless compression Methods: Huffman coding, run length coding, LZ coding, Arithmetic coding, Lossy Compression: Gray level Run length coding, Block truncation coding, vector quantization, Differential predictive coding, Transform coding , Hybrid coding, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 .

9. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.

10. Image Segmentation and Object Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005
2. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997

REFERENCES:

1. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
2. Z. Li and M.S. Drew: Fundamentals of Multimedia, Pearson, 2004.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Procesing, TataMcGraw Hill, 2004.

TOPICS IN ANALYSIS OF COMPUTER NETWORKS

Subject Code: 12SCN333

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

2. Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

3. Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

4. Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

5. Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.
2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / FieldWork / Assignment / Tutorials		I.A.	Exam		
14SCN11	Wireless Adhoc Networks	4	2 *	03	50	100	150	4
14SCN12	Advanced in Computer Networks	4	2 *	03	50	100	150	4
14SCN13	Information and Network Security	4	--	03	50	100	150	4
14SCN14	Advanced in Storage Area Network	4	2	03	50	100	150	4
14SCN15x	Elective – I	4	2	03	50	100	150	4
14SCN16	Information and Network Security Laboratory	0	3	03	25	50	75	2
14SCN17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I

14SCN152 Computer Systems Performance Analysis

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH (COMPUTER NETWORK ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14SCN21	Multimedia Communications	4	2 *	03	50	100	150	4
14SCN22	Distributed Computing	4	--	03	50	100	150	4
14SCN23	Network Management	4	2 *	03	50	100	150	4
14SCN24	Switching & Statistical Multiplexing In Telecommunications	4	2	03	50	100	150	4
14SCN25 _x	Elective – II	4	2	03	50	100	150	4
14SSCN26	Distributed Computing Laboratory	0	3	03	25	50	75	2
14SCN27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCN252 Wireless Sensor Networks

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	--	--	-	25	--	25	1
14SCN32	Report on Internship	--	--	-	--	75	75	15
14SCN33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	--	--	3	25	125	150	20

ELECTIVE- III

14SCN422

Service Oriented Architecture

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS	
		Lecture	Fieldwork / Assignment / Tutorials		I.A.	Exam			
14SCN41	Client Server Programming *	4	2 *	03	50	100	150	4	
14SCN42x	Elective-III	4	2	03	50	100	150	4	
14SCN43	Evaluation of Project Phase-II	0	--	--	25	--	25	1	
14SCN44	Evaluation of Project Phase-III	0	--	--	25	--	25	1	
14SCN45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	150	18	
Total		08	07	09	150	400	550	28	
Grand Total (I to IV Sem.)		Marks: 2400; Credits : 94							

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or technical paper.

1).Project Phase – I : 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase – III : Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be $50+50+100=200$ (50 Marks for Internal Guide, 50 Marks for External and 100 for Viva-Voce)

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Course Title: Wireless Ad-hoc Networks	Course Code: 14SCN11
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To explore the design space and conduct trade-off analysis between performance and resources.
- To Determine suitable medium access protocols and radio hardware.
- To learn Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- To explore the Ad-hoc network concepts by using network simulators.

TOPICS

MODULE I

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet;
MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas
 (Chapter 5: 5.1-5.3, Chapter 6: 6.1-6.8) **10 Hours**

MODULE II

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols
 (Chapter 7: 7.1-7.6, 7.8, 7.9) **10 Hours**

MODULE III

Multicast Routing in Ad hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
 (Chapter 8: 8.1-8.7) **10 Hours**

MODULE IV

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad hoc Wireless Networks.
 (Chapter 9: 9.1-9.6, 9.7-9.12) **10 Hours**

MODULE V

Quality of Service and Energy Management in Ad hoc Wireless Networks

Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

(Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6)

10 Hours

LABORATORY WORK

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.
- 2: Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.
4. Develop and Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.
5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

COURSE OUTCOMES

Students will be able to

- Apply knowledge of wireless Ad-hoc networks to various application areas.
- Design, implement and maintain wireless Ad-hoc networks.
- Formulate and solve problems creatively.
- Practical knowledge acquired by hands-on session.

TEXT BOOKS:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

Semester I

Year: 2014-2015

Course Title: Advances in Computer Networks	Course Code: 14SCN12
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To become familiar with the basics of Computer Networks.
- To learn Network architectures.
- To learn Concepts of fundamental protocols.
- To gain the knowledge of internetworking concepts.
- To understand the knowledge of internetworking concepts in various applications.
- To acquire knowledge of implementation concepts in congestion control and error detections.

TOPICS

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1:Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 **T2:Chapter 4**

10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2.

10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

T1: Chapter 3.3, 4.1.1, 4.1.3 **T2:** Chapter 13.1 to 13.18, Chapter 18.

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3

10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP).

T1: Chapter 6.4 **T2:** Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8

10 Hours

LABORATORY WORK

PART A: Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

COURSE OUTCOMES

Students will be able to

- Classify network services, protocols and architectures, explain why they are layered.
- Knowledge on key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Practical knowledge gained by hands-on sessions.
- Gain the knowledge of application layer protocol.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier - 2014
2. **T2: Douglas E Comer,** “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Inte rfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill.

Semester I

Year: 2014-2015

Course Title: Information and Network Security	Course Code: 14SCN13
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

TOPICS

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, ..

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer** :SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication

plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

References

1. V k Pachghare: Cryptography and Information Security. PHI Learning. ISBN 978-81-203-3521-9

Semester I

Year: 2014-2015

Course Title: Advances in Storage area Network	Course Code: 14SCN14
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre’s maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems
- To appreciate the use of cables technologies used in SAN technology.

TOPICS

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **10 Hours**

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **10 Hours**

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network;

Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Have Knowledge on various RAID levels.
- Apply the techniques used for data maintenance.
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Semester I

Year: 2014-2015

Course Title: Advanced algorithms	Course Code: 14SCN151
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To get an awareness of probabilistic and randomize algorithms.

TOPICS

MODULE I

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

COURSE OUTCOMES:

The students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Get knowledge about different application based algorithm.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Course Title: Computer Systems Performance Analysis	Course Code: 14SCN152
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To understand the concept of planning and design in computer system.

TOPICS

TOPICS:

MODULE I

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

10 Hours

MODULE II

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

10 Hours

MODULE III

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

10 Hours

MODULE IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. **Experimental Design and Analysis: Introduction:** Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

10 Hours

MODULE V

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow

Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Define Little's law and other operational laws
- Apply the operational laws to open and closed systems
- Use discrete-time and continuous-time Markov chains to model real world systems
- Develop analytical techniques for evaluating scheduling policies

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Semester I

Year: 2014-2015

Course Title: Multi-core Architecture and Programming	Course Code: 14SCN153
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multi core architectures
- To expose the students to warehouse-scale and embedded architectures

TOPICS

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

10 Hours

MODULE II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours

MODULE III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours

MODULE IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006.

Semester I

Year: 2014-2015

Course Title: Soft Computing	Course Code: 14SCN154
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

Topics:

MODULE I

Introduction to Soft computing, Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model. **10 Hours**

MODULE II

Perceptron Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propogation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models) **10 Hours**

MODULE III

Introduction to classical sets and fuzzy sets, Classical relations and fuzzy relations, Membership functions, **10 Hours**

MODULE IV

Defuzzification, Fuzzy decision making, and applications **10 Hours**

MODULE V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA
General genetic algorithms, The schema theorem, Genetic programming, applications

10 Hours

Course Outcomes:

The student will be able to:

- Implement machine learning through neural networks.

- Write Genetic Algorithm to solve the optimization problem
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.

Text book:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, Jun-2007
(Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

Reference Books:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, PHI (EEE edition) ISBN: 978-81-203-2243-1

Semester I

Year: 2014-2015

Course Title: Information and Network security Lab	Course Code: 14SCN16
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives:

- To understand the fundamentals of Cryptography through practical implementation.
- To implement standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to use cutting edge simulation tools
- To design security applications in the field of Information technology.

LABORATORY WORK

Note: Use C/C++/Java or equivalent tool to implement the following experiment

1. Consider a file with composite data, substitute the content and transpose the ciphers.
2. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
3. Apply the RSA algorithm on a text file to produce cipher text file.
4. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
5. Implementation of Message Authentication Code using cryptography VMAC function.
6. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output
7. Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN [Subnetting].
8. Develop a mechanism to setup(configure) a port scanner and identify the intrusion.

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Semester II

Year: 2014-2015

Course Title: Multimedia Communications	Course Code: 14SCN21
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

Course Objectives:

- To understand the Multimedia Communication Models
- To study the Multimedia Transport in Wireless Networks
- To solve the Security issues in multimedia networks
- To explore real-time multimedia network applications.
- To explore different network layer based application.

TOPICS

MODULE I

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework. **10 Hours**

MODULE II

Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards. **10 Hours**

MODULE III

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access. **10 Hours**

MODULE IV

Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution. **10 Hours**

MODULE V

Network Layer: Introduction, QoS in Network Multimedia Systems. **10 Hours**

LABORATORY WORK

The following experiments should be practiced (Tools such as HTML/Frontpage/Dreamweaver/ equivalent, Multimedia application enabling software ,System software support for multimedia, Performance measurement tools for multimedia ,Multimedia authoring tools, Web tools and applications)

1. Audio and video editing
2. Image editing
3. 2D and 3D animation.

.The case studies are:

- Video on-demand
- Interactive TV
- Home shopping
- Remote home care
- Electronic album
- Personalized electronic journals.

COURSE OUTCOMES:

Students will be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network applications.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

Semester II

Year:2014-2015

Course Title: Distributed Computing	Course Code: 14SCN22
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To learn Basic Concepts of DSM, Hardware DSM
- To understand File Sharing, DFS Implementation, Replication in DFS,
- To understand the concepts of Cryptanalysis, Secure channels, Access control.
- To understand some of the security concepts in distributed computing.

TOPICS

MODULE I

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

10 hours

MODULE II

Distributed Shared Memory :Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

10 hours

MODULE III

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies. **Naming**: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

10 hours

MODULE IV

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies.

10 hours

MODULE V

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS. **Emerging Trends in distributed Computing**: Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

10 hours

COURSE OUTCOMES:

The student will be able to

- Realize shared memory concept.
- Realize Advantages of DFS.
- Implement mechanisms to manage security in DS

Text Book.

1. Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010

Semester II

Year:2014-2015

Course Title: Network Management	Course Code: 14SCN23
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the need for interoperable network management.
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP and TMN.
- To understand network management as a typical distributed application

TOPICS

MODULE I

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. **10 Hours**

MODULE II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. **10 Hours**

MODULE III

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model
SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. **10 Hours**

MODULE IV

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles. **10 Hours**

MODULE V

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation

Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **10 Hours**

LABORATORY WORK:

1. Capture packets transferred while browsing a selected website (e.g. a page from the course website, a search engine home page). Investigate the protocols used in each packet, the values of the header fields and the packet sizes.
2. Explore at least the following features of Wireshark: filters, Flow Graphs (TCP), statistics, protocol hierarchies.
3. Create several example files for your Apache web server to serve. Configure your web server, and then ask a friend to test your web server by accessing the files. Capture the packets and observe the log file.
4. Configure authentication for a specific directory on your web server. Test, captured packets and observe the log file.
5. Login to another computer in the lab, capture and investigate the data exchanged.
6. Trace the path between several pairs of source/destination nodes.
7. Create fire wall rule(s) that will drop TCP packets destined to a specific computer on the lab network (e.g. yours neighbors computer).
8. Using the supplied client/server sockets programs, implement a third proxy server.

Note: NS2 or equivalent tool to be used.

Course Outcomes:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Semester II

Year:2014-2015

Course Title: Switching & Statistical Multiplexing in Telecommunications	Course Code: 14SCN24
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand Switching and multiplexing.
- To understand the transmission technology.
- To understand the transmission control.
- To understand basic knowledge on telecommunication.

Topics:

MODULE I

Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. **Why Digital:** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

10 Hours

MODULE II

Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

10 Hours

MODULE III

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. **Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

10 Hours

MODULE IV

Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

10 Hours

MODULE V

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

10 Hours

Course Outcomes:

The student will be able to:

- Gain the knowledge about switching and multiplexing
- Gain the knowledge about telecommunication.
- Learn transmission control in telecommunication.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Semester II

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCN251
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To gain knowledge Virtualization
- To gain knowledge Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- To gain knowledge in cloud resource virtualization and scheduling.

TOPICS:

MODULE I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

MODULE II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

MODULE III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study:Xen a VMM based

paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

MODULE IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

MODULE V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

Course Outcomes:

The student will be able to:

- Demonstrate simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Semester II

Year:2014-2015

Course Title: Wireless Sensor Networks	Course Code: 14SCN252
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.

- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

TOPICS:

MODULE I

Introduction, Overview and Applications of Wireless Sensor Networks

Introduction, Basic overview of the Technology, **Applications of Wireless Sensor Networks:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology

(Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)

10 Hours

MODULE II

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, **Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Available Wireless Technologies

(Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)

10 Hours

MODULE III

MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **Routing Protocols for Wireless Sensor Networks:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

(Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)

10 Hours

MODULE IV

Transport Control and Middleware for Wireless Sensor Networks

Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. **Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

(Chapter 7: 7.1-7.4, Chapter 8: 8.1-8.4)

10 Hours

MODULE V

Network Management and Operating System for Wireless Sensor Networks

Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. **Operating Systems for Wireless Sensor Networks:** Introduction, Operating System Design Issues, Examples of Operating Systems.

(Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)

10 Hours

COURSE OUTCOMES

The student will be able to:

- Develop applications of wireless sensor actuator networks
- Implement the elements of distributed computing and network protocol .

- Explore various hardware, software platforms that exist for sensor networks

TEXT BOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications”, WILEY , Second Edition (Indian) , 2014

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.

Semester II

Year: 2014-2015

Course Title: Optical Networks	Course Code: 14SCN253
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM
- To acquire knowledge about fault and congestion management.

Topics

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours

MODULE II

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum Load **Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Design a system, component or process as per needs and specification.
- Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
- Gain the knowledge on methodologies of optical network design optimization;
- Explore techniques of optical network survivability.
- Solve the Problems in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advances in VLSI Design and Algorithms	Course Code: 14SCN254
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- Able to understand the fundamentals of CMOS VLSI and associated technologies.
- Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
- Able to appreciate the design process in VLSI, GALS.
- Able to explain basic operation principles of diodes and MOS FPGAs; PLA.
- Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout

TOPICS:**MODULE I**

Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing; Integrated Circuit Design Techniques; IP-Based Design.

Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

10 Hours**MODULE II**

Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

10 Hours**MODULE III**

Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

10 Hours**MODULE IV**

Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

10 Hours**MODULE V**

Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

10 Hours

Course Outcomes:

The student will be able to:

- Clear understanding of important concepts in CMOS technology and fabrication that affect design.
- Apply two-level and multi-level logic minimization techniques to the given Boolean logic function.
- Design and develop Layout a gate in CMOS VLSI technology.

TEXT BOOKS:

1. Wayne Wolf: “Modern VLSI design”, 4th Edition, P HI Learning, 2007.
2. Sabih H Gerez: “Algorithms for VLSI Design Autom ation”, Wiley India, 2007.

Semester II

Year: 2014-2015

Course Title: Distributed Computing Lab	Course Code: 14SCN26
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives

- To understand the main ideas and concepts on web services.
- Studying and working on a related topic of internet applications such as information hiding, system security and E-learning.
- To understand the concepts of UDDI, SOAP, JMS remote procedure calls.

LIST OF EXPERIMENTS:

Note: Use appropriate tools/language to implement the following experiment:

1. Design and implement client server application using RMI (Remote Method Invocation) to invoke a service to calculate the income tax.
2. Design and implement EJB (Entity Java Beans) session bean business logic to calculate income tax and invoke the service using stub, i.e., client side proxy object.
3. Design and implement an EJB entity bean to persist the client submitted data into an enterprise information system.
4. Design and implement an offline database communication system using JMS (Java Message Service) to service the client request.
5. Design and implement the client code to call the Micro soft service like free service from UDDI (Universal Description Discovery Protocol).
6. Design and implement business logic and bind it as service using SOAP (Simple Object Access Protocol), also implement client to call service.

NOTE: Use EJB 3.X or any equivalent tool.

COURSE OUTCOMES:

The student will be able to

- Develop and debug RPC based client-Server programs in UNIX.
- Realize the partial implementation of UDDI, SOAP, JMS in Web applications.

Semester IV

Year: 2014-2015

Course Title: Client-Server Programming	Course Code: 14SCN41
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand **Client-Server software**, Context Switching and Protocol Software, I/o.
- To understand System Calls, Basic I/O Functions available in UNIX
- To understand the Socket interface, TCP, UDP in detail.
- Various client software applications and their issues.
- To understand the concept of Socket interface in client server programming.

TOPICS:

MODULE I

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts
Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP. **10 Hours**

MODULE II

The Socket Interface: Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **10 Hours**

MODULE III

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays,

A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

MODULE IV

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

MODULE V

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

LABORATORY WORK:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Design, develop, and execute a program using JAVA networking facilities to implement a simple Day / Time Server and demonstrate its functioning. Repeat the above problems.

COURSE OUTCOMES

The student will be able to:

- Gain in depth knowledge about Client-Server software, Context Switching and Protocol Software, I/o.
- Programming System Calls, Basic I/O Functions available in UNIX
- Gain the knowledge on Socket interface, TCP, UDP in details.
- Pros and cons of Client Software Various applications and their issues.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Title: Analysis of Computer Networks	Course Code: 14SCN421
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To Become familiar with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- To analyze network architectures in stochastic and deterministic way.
- RSVP, Principles of TCP
- To explore more on different network protocols.
- To understand the knowledge of multiplexing, streaming sessions in computer network.

TOPICS:**MODULE I**

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

10 Hours**MODULE II**

Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

10 Hours**MODULE III**

Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

10 Hours**MODULE IV**

Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

10 Hours**MODULE V**

Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

10 Hours**Course Outcomes:**

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

Semester IV

Year:2014-2015

Course Title: Service Oriented Architecture	Course Code: 14SCN422
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand various architecture for application development
- To understand the importance of SOA in Application Integration
- To learn web service and SOA related tools.
- To learn the concepts of SOA governance.

Topics:

MODULE I

SOA BASICS: Software Architecture – Types of IT Architecture – S OA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architec ture – Enterprise Applications – Solution Architect ure for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models

10 Hours

MODULE II

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Ac tivity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits o f SPA – Cost Savings

10 Hours

MODULE III

SOA GOVERNANCE :SOA implementation and Governance – strategy – SOA d evelopment – SOA governance – trends in SOA – event-driven architect ure – software s a service – SOA technologies – pro of-of-concept – process orchestration – SOA best practice s

10 Hours

MODULE IV

SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL, SOAP and Java/XML mapping in SOA – JAXB Data binding.

10 Hours

MODULE V

APPLICATION INTEGRATION: JAX-WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study – WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Compare the different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Text Book:

1. Shankar Kambhampaly, “Service-Oriented Architecture for Enterprise Applications”, Wiley 2008.

REFERENCES:

2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.
3. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009.

Semester IV

Year: 2014-2015

Course Title: Mobile Application Development	Course Code: 14SCN423
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To Understand system requirements for mobile applications
- To Generate suitable design using specific mobile development frameworks
- To Generate mobile application design
- To Implement the design using specific mobile development frameworks
- To acquire knowledge of android applications development.

Topics:

MODULE I

Introduction to mobile communication and computing:, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover

and security. Smart phone operating systems and smart phones applications.

10 Hours

MODULE II

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control .

10 Hours

MODULE III

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

10 Hours

MODULE IV

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations,

10 Hours

MODULE V

Displaying web pages and maps, communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications.

10 Hours

Course Outcomes:

The student will be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop and design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS

Text Books:

1. Mobile Computing: Technologies and Applications- N. N. Jani S chand,2009.
2. B.M.Hirwani- Android programming Pearson publications-2013

Course Title: Cybercrime and Digital Forensic	Course Code: 14SCN424
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To understand Accounting Forensics
- To analyze the nature and effect of cyber crime in society.
- To understand Sarbanes-Oxley Financial and Accounting Disclosure Information
- To understand Computer Crime and Criminals
- To understand Liturgical Procedures

Topics:**MODULE I**

INTRODUCTION: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

10 Hours**MODULE II**

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

10 Hours**MODULE III**

INVESTIGATION: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

10 Hours**MODULE IV**

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. **10 Hours**

MODULE V

LAWS AND ACTS: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

10 Hours

Course Outcomes

The student will be able to:

- Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.
- Distinguish various types of computer crime, and use computer forensic techniques to identify the digital fingerprints associated with criminal activities.
- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- Develop a custom computer forensic analysis tool.

Text:

1. Nelson Phillips and Einfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw -Hill , New Delhi, 2006.

References:

3. Robert M Slade, “Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

I Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work/ Assignment/ Tutorials		I.A.	Exam	
12SCN11	Advanced Digital Communication	4	2#	3	50	100	150
12SCN12	Computer Networks	4	2*	3	50	100	150
12SCN13	Network Programming	4	2*	3	50	100	150
12SCN14	Information Security	4	2#	3	50	100	150
12SCN15x	Elective – I	4	2	3	50	100	150
12SCN16	Seminar	--	3	--	50	--	50
Total		20	13	15	300	500	800

Elective I

12SCN151 C# and .Net

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

II Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam	
12SCN21	Wireless & Mobile Networks	4	2*	3	50	100	150
12SCN22	Client-Server Programming	4	2*	3	50	100	150
12SCN23	Optical Networks	4	2#	3	50	100	150
12SCN24	Switching & Statistical Multiplexing in Telecommunications	4	2#	3	50	100	150
12SCN25	Elective – II	4	2	3	50	100	150
	**Project Phase-I(6 Week						
12SCN26	Seminar	--	3	--	50	--	50
Total		20	13	15	300	500	800

Elective – II

12SCN254 Cloud Computing

** Between the II Semester and III Semester after availing a vocation of 2 weeks.

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

III Semester

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam	
12SCN31	Network Management	04	--	03	50	100	150
12SCN32x	Elective – III	04	02	03	50	100	150
12SCN33x	Elective – IV	04	02	03	50	100	150
12SCN34	Project Phase - II		§				
12SCN35	Evaluation of Project Phase-I	–	03	–	50	–	50
Total		12	07	09	200	300	500

Elective – III

12SCN321 Protocols Engineering

Elective – IV

12SCN331 Wireless Sensor Networks

§ 3 Days Course work and 3 days for Project work

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. COMPUTER NETWORK ENGINEERING**

IV Semester

Course Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
12SCN41	Evaluation of Project Phase – II	-	-	-	50	-	50
12SCN42	Evaluation of Project work – III	-	-	-	50	-	50
12SCN43	Project work evaluation and Viva-voce	-	-	03	-	100+100	200
	Total	-	-	03	100	200	300
Grand Total (I to IV Sem.) : 2400							

Note: Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

Note:

* Lab Classes for any two core subjects are compulsory (practical will be evaluated for 20 marks and internal assessment for 30 marks. Lab journals should be maintained).

For the remaining two core subjects, it can be field work, assignment, tutorials.

- 1) Project Phase – I : 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation. Evaluation of the same shall be taken up during beginning of III Semester. Total Marks shall be 50. Colleges have to send the synopsis after Phase – I.
- 2) Project Phase – II: 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 50.
- 3) Project Phase– III: 24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. Total Marks shall be 50. At the end of the Semester Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 50 + 50 + 100 = 200 (50 marks for guide, 50 marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

The Marks of Project Phase – I shall be sent to the University along with III Semester I.A. Marks of other subjects.

The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.

- 4) During the final viva, students have to submit all the reports.
- 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).

ADVANCED DIGITAL COMMUNICATION

Subject Code: 12SCN11

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Digital Transmission Fundamentals: Digital Representation of Information: Block-Oriented Information, Stream Information; Why Digital Communications? Comparison of Analog and Digital Transmission , Basic properties of Digital Transmission Systems; Digital Representation of Analog Signals: Bandwidth of Analog Signals, Sampling of an Analog Signal, Digital Transmission of Analog Signals; Characterization of Communication

Channels: Frequency Domain Characterization, Time Domain Characterization;

Fundamental Limits in Digital Transmission: The Nyquist Signaling Rate, The Shannon Channel Capacity; Line Coding ; Modems and Digital Modulation: Binary Phase Modulation, QAM and Signal Constellations, Telephone Modem Standards; Properties of Media and Digital Transmission Systems: Twisted Pair, Coaxial Cable, Optical Fiber, Radio Transmission, Infrared Light; Error Detection and Correction: Error Detection, Two Dimensional Parity Checks, Internet Checksum, Polynomial Codes, Standardized Polynomial Codes, Error Detecting Capability of a Polynomial Code.

2. Brief Review of digital communication systems: Elements of Digital communication systems; Communication channels and their characteristics; Historical perspective in the development of digital communication; Review of the features of a decreases memory less channel and the channel capacity theorem

3. Wave form Coding Techniques: PCM, Channel. Noise and error probability, DPCM, DM, coding speech at low bit rates, Applications.

4. Base band Shaping for data transmission: Discrete PAM signals, Inter-symbol interference (ISI) Nyquist criterion for distortion-less Base band binary transmission, correlative coding, Eye-pattern, transmission, correlative coding, Eye-patterns Based and M-ary PAM system, Adaptive Equalization, The zero forcing algorithm, The LMA algorithm

TEXT BOOKS:

1. Alberto Leon – Garcia and Indra Widjaja: Communication Networks – Fundamental Concepts and Key architectures, 2nd Edition, Tata McGrawHill, 2006.
2. Simon Haykin: Digital Communication, Wiley India, 2007.

REFERENCE BOOKS:

1. John G Proakis: Digital Communications, 3rd Edition, McGraw Hill, 2008.
2. Leon W Couch: Analog / Digital Communication, 5th Edition, PHI, 2008.

COMPUTER NETWORKS

Subject Code: 12SCN12

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Review of Basic Concepts: Building a Network; Requirements- Connectivity, Cost-Effective Resource Sharing, Support for Common Services; Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture; Performance- Bandwidth and Latency, Delay× Bandwidth Product, High-Speed Networks.

2. Direct link networks: Hardware Building Blocks-nodes, links; error Detection- Two-Dimensional Parity, Internet checksum Algorithm, cyclic Redundancy Check; reliable Transmission- Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Rings (802.5, FDDI) –Token Ring Media Access Control, Token Ring Maintenance, FDDI.

3. Packet Switching: Switching and forwarding – Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches – Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges; cell switching (ATM) – Cells, Segmentation and Reassembly, Virtual Paths, Physical Layers for ATM.

4. Internetworking: Simple internetworking (IP) – What Is an Internetwork?, Service Model, Global Address, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels; Routing – Network as a Graph, distance Vector(RIP), Link State(OSPF), Metrics, Routing for Mobile Hosts, Global Internet – Subnetting, Classless Routing(CIDR), Interdomain Routing(BGP), Routing Areas, IP Version 6(IPv6).

5. End –to-End Protocols: Simple demultiplexer (UDP); Reliable byte stream (TCP) – End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Alternative Design Choices.

6. Congestion Control and Resource Allocation: Issues in resource allocation – Network Model, Taxonomy, Evaluation Criteria; Queuing discipline – FIFO, Fair Queuing; TCP Congestion Control – Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion-Avoidance mechanisms – DECbit, Random Early Detection (RED), Source-Based Congestion Control.

7. Applications: Traditional applications – Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Name Service (DNS), Network management (SNMP); Web services – Custom APPLICATION Protocols (WSDL, SOAP), A Generic application Protocol (REST).

Laboratory Work:

Using any Protocol Analyzer like Ethereal, perform the following experiments:

1. Capture the packets that are transmitted after clicking on the URL of the web site of your college. Analyze the packets at the highest level and prepare a brief report of your analysis.
2. Analyze the data captured above at lower levels and demonstrate the layering of the protocols.
3. Capture the packets in the LAN, & filter for a unique subscriber
4. Capture the ARP packets and find the MAC addresses in the LAN in your laboratory.

Using either NS228/OPNET or any other suitable simulator, perform the following experiments:

1. Simulate an Ethernet LAN using 10 nodes, change error rate and data rate, and compare throughput
2. Simulate a three nodes point-to-point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Implement the following in C/C++:

1. Write a program for distance vector algorithm to find suitable path for transmission.
2. Write a program for error detecting code using CRC-CCITT (16-bit)
3. Write a program for congestion control using leaky bucket algorithm.

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks –Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

NETWORK PROGRAMMING

Subject Code: 12SCN13

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Review of Basic Concepts:** Layering, OSI model, Processes, A simplified model, Client-Server model, A history of Unix Networking; Review of TCP/IP.
- 2. Sockets:** Introduction, Unix domain protocols, socket addresses, elementary socket system calls, advanced socket system calls, reserved ports, stream pipes, passing file descriptions, socket options, asynchronous I/O, Input/Output Multiplexing, Out-of-Band data, sockets and signals, Internet superservers, socket implementation.
- 3. TFTP Protocol:** Introduction, protocol, security, data formats, connections, client user interface, UDP implementation, TCP implementation.
- 4. Remote Command Execution:** Introduction, Security issues, rcmd function and rshd server, rexec function and rexecd server.
- 5. Remote Login:** Introduction, Terminal line disciplines, pseudo terminal, terminal modes, control terminals rlogin overview, rlogin client, rlogin server.
- 6. JAVA Network Programming:** Introduction, Client-Server Computing, The InetAddress class, Serving multiple clients, Applet clients, Sending and receiving objects, Retrieving objects from Web servers, Datagram sockets.

TEXT BOOKS:

1. W. Richard Stevens: Unix Network Programming, PHI, 2001.
2. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson, 2007.

REFERENCE BOOKS:

1. W. Richard Stevens: TCP/IP Illustrated, Volumes 1, 2, and 3, Pearson, 2000.

Laboratory Work:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple echo server and demonstrate its working. Both the server and client are to be connection-oriented and use TCP. The system works as follows: Client reads a line from the standard input and writes the line to the server; the server reads a line from its network input and echoes the line back to the client; the client reads the echoed line and prints it on its standard output.
2. Repeat the above experiment using UDP instead of TCP.
3. Repeat the Experiment 1 using JAVA network programming facilities.
4. Modify the above program such that the client sends an integer value supposed to represent the radius of a circle and the server is to compute and return the corresponding area.
5. Extend the above program such that the server responds to multiple clients.

Mini Project: Design, develop, and execute a program in C under UNIX / LINUX environment to implement any utility in TCP/IP suite like PING, TFTP etc.

Information Security

Subject Code: 12SCN14

IA Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction to Information Security: Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.

2. Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.

3. Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections. Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.

4. Information Security maintenance: Introduction; Security Management Models; The Maintenance Model.

5. Introduction to Network Security: Attacks, Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs; Wireless network security.

6. Cryptography: Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.

7. Authentication Applications: Kerberos, X.509 Directory Authentication Service.

8. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

9. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.

10. Web Security: Web security requirements, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET).

11. Software: Introduction; Software flaws; Malware; Software-based attacks; Digital Rights Management;

TEXT BOOKS:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.
2. William Stallings: Network Security Essentials Applications and Standards, Person, 2000.
3. Deven N. Shah: Information Security – Principles and Practice, Wiley India, 2009.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Cryptography and Network Security, Tata McGraw-Hill, 2007.

Elective I

12SCN151 C# and .Net

12SCN152 Stochastic Models and Applications

12SCN153 System Modeling and Simulation

12SCN154 Embedded Systems

C# and .Net

Subject Code: 12SCN151

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. The Philosophy of .NET: Understanding the Previous State of Affairs, The .NET Solution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the.NET Base Class Libraries, What C# Brings to the Table, An Overview of.NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifest, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Runtime A tour of the.NET Namespaces, Increasing Your Namespace Nomenclature, Deploying the .NET Runtime.

2. Building C# Applications: The Role of the Command Line Compiler (csc.exe), Building C # Application using csc.exe Working with csc.exe Response Files, Generating Bug Reports , Remaining C# Compiler Options, The Command Line Debugger (cordbg.exe) Using the, Visual Studio .NET IDE, Other Key Aspects of the VS.NET IDE, C# “Preprocessor:” Directives, An Interesting Aside: The System. Environment Class

3. C# Language Fundamentals: The Anatomy of a Basic C# Class, Creating objects: Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node: System, Object, The System Data Types (and C# Aliases),Converting Between Value Types and Reference Types: Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining

Custom Namespaces.

4. Object- Oriented Programming with C#: Forms defining of the C# Class, Definition the “Default Public Interface” of a Type, Recapping the Pillars of OOP, The First Pillars: C#’s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#’s Inheritance Supports, keeping Family Secrets: The “Protected” Keyword, Nested Type Definitions, The Third Pillar: C #’s Polymorphic Support, Casting Between

5. Exceptions and Object Lifetime: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handling, the System, Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System. System Exception), Custom Application- Level Exception (System. System Exception), Handling Multiple Exception, the Family Block, the Last Chance Exception. Dynamically Identifying Application and System Level Exception Debugging System Exception Using VS.NET, Understanding Object

Lifetime, the CIT of “new’, The Basics of Garbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations, The System. GC Type.

6. Interfaces and Collections: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, Implementing, Implementation, Interfaces Using VS .NET, understanding the IConvertible Interface, Building a Custom Enumerator(IEnumerable and Enumerator), Building Cloneable objects (ICloneable), Building Comparable Objects (IComparable), Exploring the system. Collections Namespace, Building a Custom Container (Retrofitting the Cars Type). Callback Interfaces, Delegates, and Events, Advanced Techniques Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example,

Understanding Asynchronous Delegates, Understanding (and Using)Events. The Advances Keywords of C#, A Catalog of C# Keywords Building a Custom Indexer, A Variation of the Cars Indexer Internal Representation of Type Indexer. Using C# Indexer

from VB.NET. Overloading operators, The Internal Representation of Overloading Operators,

interacting with Overload Operator from Overloaded- Operator- Challenged Languages, Creating Custom, Conversion Routines, Defining Implicit Conversion Routines, The Internal\Representations of Customs Conversion Routines

7. Understanding .NET Assemblies: Problems with Classic COM Binaries, An Overview of .NET Assembly, Building a Simple File Test Assembly, A C#, Client Application, A Visual Basic .NET Client Application, Cross Language Inheritance, Exploring the CarLibrary's, Manifest, Exploring the CarLibrary's Types, Building the Multifile Assembly ,Using Assembly, Understanding Private Assemblies, Probing for Private Assemblies (The Basics), Private A Assemblies XML Configurations Files, Probing for Private Assemblies (The Details),Understanding Shared Assembly, Understanding Shared Names, Building a Shared Assembly, Understanding Delay Signing, Installing/Removing Shared Assembly, Using a Shared Assembly.

TEXT BOOKS:

1. Andrew Troelsen: Programming C# with .NET 3.0, 4th Edition, Wiley India, 2009.
2. E. Balagurusamy: Programming in C#, 2nd Edition, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

1. Tom Archer: Inside C#, WP Publishers, 2001.
2. Herbert Schildt: C# - The Complete Reference, Tata McGraw Hill, 2004.

STOCHASTIC MODELS AND APPLICATIONS

Subject Code: 12SCN152

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: A Speech Recognition System, A Radar System, A Communication Network.

2. Introduction to Probability Theory: Experiments, Sample Spaces, and Events, Axioms of Probability, Assigning Probabilities, Joint and Conditional Probabilities, Bayes's Theorem, independence, Discrete random Variables, Engineering Application: An Optimal Communication System

3. Random variables, Distributions, and Density Functions: The Cumulative Distribution Function, The Probability Density Function, The Gaussian Random Variable, Other Important Random Variables, Conditional Distribution and Density Functions, Engineering Application: Reliability and Failure Rates

4. Random Processes: Definition and Classification of Processes, Mathematical Tools for Studying Random Processes, Stationary and Ergodic Random Processes, Properties of the Autocorrelation Function, Gaussian random Processes, Poisson Processes, Engineering Application: Shot Noise in a p-n Junction Diode

5. Markov Processes: Definition and Examples of Markov Processes, Calculating Transition and State Probabilities in Markov Chains, Characterization of Markov Chains, Continuous Time Markov Processes, Engineering Application: A Telephone Exchange

6. Poisson Processes, Queuing Theory: The non-stationary Poisson process; The stationary Poisson process; Some Poisson process computations; Classifying the events of a non-stationary Poisson process; Conditional distribution of the arrival times. Queuing Theory: Introduction; Preliminaries; Exponential models; Birth-and-Death exponential queuing systems; The backwards approach in exponential queues; A closed queuing network; An open queuing network; The M/G/1 queue; Priority queues.

7. Simulation Techniques: Computer Generation of Random Variables, Generation of Random Processes, Simulation of Rare Events, Engineering Application: Simulation of a Coded Digital Communication System.

TEXT BOOKS:

1. Scott L. Miller, Donald G. Childers: Probability and Random Processes With Applications to Signal Processing and Communications, Elsevier, 2004.
2. Sheldon M. Ross: Probability Models for Computer Science, Elsevier, 2002.

REFERENCE BOOKS:

1. R. W. Wolff: "Stochastic Modeling and Queuing Theory", Prentice Hall, 1989.
2. B. R. Bhat: "Stochastic Models Analysis and Applications", New Age International, 2000.

SYSTEM MODELING AND SIMULATION

Subject Code: 12SCN153

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Some recent applications of Simulation; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

2. General Principles: Concepts in Discrete-Event Simulation, List processing.

3. Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

4. Queuing Models: Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

5. Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers

Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

6. Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

7. Verification, Calibration, and Validation of Simulation Models: Model building, verification, and validation; Verification of simulation models; Calibration and validation of

models. Optimization via Simulation

8. Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

9. Case Study: Simulation of networked computer systems.

TEXT BOOKS:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.

REFERENCE BOOKS:

1. Lawrence M. Leemis, Stephen K. Park: "Discrete – Event Simulation: A First Course", Pearson Education, 2006.
2. Averill M. "Law: Simulation Modeling and Analysis", 4th Edition", Tata McGraw-Hill, 2007.

EMBEDDED SYSTEMS

Subject Code : 12SCN154

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

- 1. Custom single-purpose processor design;** RT level custom single-purpose processor design, optimizing custom single-purpose processors: Optimizing the original program, optimizing the FSM, Optimizing the data path, optimizing the FSM.
- 2. Timers, counters, and watchdog timers. State machine models:** introduction; An introductory example, A basic state machine model: finite-state machines(FSM);finite-state machines with data path model (FSMD);using state machines: Describing a system as a state machine, Comparing state machine and sequential program models, Capturing a state machine model in a sequential programming language; hierarchical/concurrent state machine model (HCFSM) and the state charts language; program state machine model(PSM);The role of an appropriate model and language.
- 3. Concurrent process models: concurrent processes:** process create and terminate ,process suspend and resume, Process join; Communication among processes: shared memory, Message passing; synchronization among processes: Condition variables, monitors. Interrupts: interrupt Basics; The Shared Data Problem; interrupt latency
- 4. Survey of Software Architecture:** Round Robin, Round Robin with interrupts, Function queue scheduling architecture, Real time operating system architecture, selecting architecture. Introduction to RTOS: Tasks and task states, tasks and Data, semaphores and shared data.
- 5. Operating systems services:** Message queues, mailboxes, and pipes; Timer functions; Events; memory management, Interrupt routines in an RTOS environment. Basic design using an RTOS; Overview, principles, an example, encapsulating semaphores and queues, Hard Real-time scheduling considerations, saving power.

6. **Embedded software development tools:** Host and target machines; Linker/locator for Embedded software, getting embedded software into the target system. Debugging Techniques: Testing on host machine, instruction set simulators, macros and tools.
7. **An example system:** what the program does, environment in which the program operates.

Text Books:

1. Embedded system design : A unified Hardware/software introduction – Frank Vahid, Tony Givargis, John Wiley and Sons, Inc. 2002 (Articles : 2.4, 2.5, 2.6; 4.2, 8.3 to 8.13)
2. An Embedded software Primer – David E. Simon; Pearson Education, 1999. (Chapters: 4, 5, 6, 7, 8, 9, 10 and 11)

Reference books:

1. Embedded C: Michael J. Pont, Pearson Education (2002)
2. Real-Time systems and programming languages : Alan Burns and Andy Wellings, Addison Wesley-Longman (1997)
3. Real Time programming: A guide to 32 bit embedded development, Grehan, Moore and Cyliax, Addison-Wesley-longman.

WIRELESS & MOBILE NETWORKS

Subject Code: 12SCN21

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems

2. Wireless Communications Modern Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)

3. The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations, Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference

4. Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.

5. Modulation Techniques for Mobile Radio: Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).

6. Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple

Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols, Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems

7. Wireless Networking: Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

Laboratory Work:

1. Using any package like MATLAB or using any programming language of your choice, implement the BPSK algorithm and study its performance.
2. Repeat the above experiment for QPSK algorithm and compare its performance with that of BPSK.
3. Using any Network simulation package or using any programming language of your choice, implement and study the performance of PRMA.

Mini Project: Using any platform like ANDROID, J2ME etc, implement any mobile application like Location Based Services, Emergency Services, Remote Monitoring etc.

TEXT BOOKS:

1. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2nd Edition, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. William C Y Lee: Mobile Communications Engineering Theory and Applications, 2nd Edition, McGraw Hill Telecommunications 1998.
2. William Stallings: Wireless Communications and Networks, Pearson Education Asia, 2002.

CLIENT-SERVER PROGRAMMING

Subject Code: 12SCN22

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. The Client Server Model and Software Design:** Introduction, Motivation, Terminology and Concepts
- 2. Concurrent Processing in Client-Server software:** Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O.
- 3. Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.
- 4. The Socket Interface:** Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters.
- 5. Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using

UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

6. Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

7. Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

8. Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server.

9. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

10. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes

Laboratory Work:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Repeat the above problems using JAVA networking facilities.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001.

OPTICAL NETWORKS

Subject Code: 12SCN23

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Three generations of Digital Transport Networks; A brief introduction to WDM and TDM; The Optical Marketplace; Wireless Optical Systems; Key Optical Nodes; Other Key Terms; Evolution of Optical Systems; Key attributes of Optical Fiber.

2. Telecommunications Infrastructure: The Local Connections; The Backbone Connections; The Digital Multiplexing Hierarchy; The Digital Signaling Hierarchies; T1 / DS1 and T3 / DS3; The Layered Protocol Model in the Transport Network; considerations for Interworking Layer1, Layer 2, and Layer 3 Networks.

3. Characteristics of Optical Fiber: The Basics; The Wavelength; The Basic Components; Structure of the Fiber; Fiber Types; Key Performance Properties of Fiber; Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion; Lasers.

4. Timing and Synchronization: Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and DS1; Timing Downstream Devices; Building Integrated Timing Supply; Synchronization Status Messages and Timing Loops.

5. SONET and SDH: Introduction; The SONET Multiplexing Hierarchy; SONET and SDH Multiplexing Structure; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; Virtual Tributaries in more detail; Virtual Tributaries in Virtual Containers; The Overhead Bytes; SONET and SDH Concatenation.

6. Architecture of Optical Transport Networks: The Digital Wrapper; Control Planes; In-Band and Out-Band Control Signaling; Importance of Multiplexing and Multiplexing Hierarchies; Current Digital Transport Hierarchy; SONET Multiplexing Hierarchy; SDH

Multiplexing Hierarchy; Key Indexes and Other Terms; The New Optical Transport and Digital Transport Hierarchy; The OTN Layered Model; Encapsulation and Decapsulation Operations; Generic Framing Procedure

7. WDM: The WDM Operation; DWDM, TDM and WDM Topologies; Relationship of WDM to SONET / SDH; EDF; WDM Amplifiers; Add-Drop Multiplexers; WDM Cross-Connects; Wavelength Continuity Property; Examples of DWDM Wavelength Plan; Higher Dispersion for DWDM; Tunable DWDM Lasers.

8. Network Topologies and Protection Schemes: The Non-Negotiable Requirement Robust Networks; Diversity in the Network; Line and Path Protection Switching; Types of Topologies; Working and Protection Fibers; Point-to-Point Topology; BLSR; Protection Switching on Four-Fiber BLSR; Meshed Topologies; PONs; Ethernet in the Wide Area Backbone? Metro Optical Networking

9. MPLS and Optical Networks: Label Switching; FEC; Types of MPLS Nodes; Label Distribution and Binding; Label Switching and Traffic Forwarding; MPLS Support of VPNs; MPLS Traffic Engineering; Multiprotocol Lambda Switching; MPLS and Optical TE Similarities; Possibilities for the MPIS Network; Control and Data Planes Interworking

10. Architecture of IP and MPLS-Based OTNs: IP, MPLS, and Optical Control Planes; Interworking the three Control Planes; Management of the Planes; A Framework for the IP over Optical Networks; An Opposing View; Generalized MPLS use in Optical Networks; Bi-Directional LSPs in Optical Networks; GMPLS Extensions for G.709; GMPLS with SONET and SDH.

11. The Link Management Protocol: Keep the Optical Link up and running; What is managed? Data-bearing Links; Clarification of terms; Basic functions of LMP; Control Channel Management; Link Property Correlation; Fault Management; Extending LMP operations for Optical Link Systems.

12. Optical Routers: Optical Switching; Implementation Preferences; Key Terms;

Evolution of Switching Networks; Optical Router; Optical Switching Technologies; Optical Resources; Protecting the Label Switched Paths; Protection of the OSP; Wavelength OSP and MPLS LSP; Nesting the LSPs and OSPs; Topologies for a Node Failure; Plane Coupling 31

and De-Coupling; Some End-to-End Wavelengths and Node-to-Node Wavelengths; Granularity of Labels versus Wavelength Support; Approach to the Problem of LSP and OSP Interworking; MEMS and Optical Switching; Thermo-Optic Switches.

13. ASON Operation at the UNI and NNI: Objectives of ASON; UNI and NNI; Managing the Optical Bandwidth in the ASON; General approach to Optical Bandwidth Management; IETF Optical Carrier Framework for the UNI; Types of Connections; NNI; UNI and NNI Signaling Services.

14. ATM versus IP in Optical Internets: IP over ATM over SONET; The OSI and Internet Layered Models; ATM in the SONET / SDH Payload Envelope; PPP in the SONET Payload Envelope; Encapsulation / Framing Rules; The PPP Packet; The ATM versus IP; Overhead of IP and ATM; Three encapsulation methods

15. Evolving to 3G Architecture: Migration of IP Optical Networking; IP and the Optical Backbones; Placing MPLS into the Picture; Putting it together.

TEXT BOOKS:

1. Uyles Black: Optical Networks, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. Rajiv Ramaswami and Kumar N.Sivaranjan: Optical Networks - A Practical Perspective, Morgan Kaufmann, 2000.
2. Paul E.Green Jr.: Fiber Optic Network, Prentice Hall, 1993.
3. Jeff Hecht: Understanding Fiber Optics, 4th Edition, PHI 1999.

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS

Subject Code: 12SCN24

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks
- 2. Why Digital?** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.
- 3. Switching:** Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization
- 4. Electronic Space Division Switching:** Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks.
- 5. Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoder, Pulse Transmission, Line Coding, Time Division Multiplexing.
- 6. Time Division Switching:** Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.
- 7. Traffic Engineering:** Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Elective – II

12SCN251	Distributed systems
12SCN252	Computer Systems Performance Analysis
12SCN253	Web Engineering
12SCN254	Cloud Computing
12SCN255	Web Commerce

DISTRIBUTED SYSTEMS

Subject Code: 12SCN251

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Characterization of Distributed Systems and System Models:** Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges, Architectural models, Fundamental models.
- 2. Networking and Internetworking:** Types of Networks, Networks principles, Internet protocols
- 3. Interprocess Communication:** Introduction, The API for the Internet protocols, External data representation and marshalling, Client -Server communication, Group communication, Case study: Interprocess communication in UNIX
- 4. Distributed Objects and Remote Invocation:** Communication between distributed objects, Remote procedure call, events and notifications
- 5. Operating System Support and Security:** The Operating system layer, protection, processes and threads, communication and invocation, operating system architecture
- 6. Transactions and Concurrency Control:** Transactions, nested transactions, locks, Optimistic concurrency control, timestamp ordering, comparison of methods for concurrency control.
- 7. Distributed Shared Memory:** Design and Implementation issues, sequential consistency and lvy.

TEXT BOOKS:

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems, Concept and Design, 3rd Edition, Pearson Education, 2005.

REFERENCE BOOKS:

1. Sukumar Ghosh: Distributed Systems, An Algorithmic Approach, Chapman & Hall / CRC, 2007.
2. Pradeep K. Sinha: Distributed Operating Systems, Concepts and Design, PHI, 2007.
3. Randy Chow, Theodore Johnson: Distributed Operating Systems and Algorithm Analysis, Pearson, 2009.

COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Subject Code: 12SCN252

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: The art of Performance Evaluation; Common mistakes in Performance Evaluation; A systematic approach to Performance Evaluation; Selecting an evaluation technique; Selecting performance metrics; Commonly used performance metrics; Utility classification of performance metrics; Setting performance requirements.

2. Workloads, Workload Selection and Characterization: Types of workloads: addition instructions; Instruction mixes; Kernels; Synthetic programs; Application benchmarks; Popular benchmarks. Work load selection: Services exercised; Level of detail; Representativeness; Timeliness; Other considerations in workload selection.

Work load characterization techniques: Terminology; Averaging; Specifying dispersion; Single-parameter histograms; Multi-parameter histograms; Principle-component analysis; Markov models; Clustering.

3. Monitors, Program Execution Monitors, and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors; Software versus hardware monitors; Firmware and hybrid monitors; Distributed system monitors. Program execution monitors and accounting logs: Program execution monitors; Techniques for improving program performance; Accounting logs; Analysis and interpretation of accounting log data; Using accounting logs to answer commonly asked questions.

4. Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in capacity planning; Common mistakes in benchmarking; Benchmarking games; Load drivers; Remote-terminal emulation; Components of an RTE; Limitations of RTEs

5. Experimental Design and Analysis: Introduction: Terminology; Common mistakes in experiments; Types of experimental designs. 2k Factorial Designs: Concepts; Computation of effects; Sign table method for computing effects; Allocation of variance; General 2k

Factorial Designs. General full factorial designs with k factors: Model; Analysis of a general design; Informal methods.

6. Queuing Models: Introduction: Queuing notation; Rules for all Queues; Little's law; Types of stochastic processes. Analysis of Single Queue: Birth-Death processes; M / M / 1 Queue; M / M / m Queue; M / M / m / B Queue with finite buffers; Results for other M / M / 1 Queuing Systems.

Queuing Networks: Open and closed Queuing Networks; Product form networks;

Queuing Network models of Computer Systems. Operational Laws: Utilization law; Forced flow law; Little's law; General response time law; Interactive response time law; Bottleneck analysis. Mean Value analysis and related techniques: Analysis of open queuing networks; Mean value analysis; Approximate MVA; Balanced job bounds.

Convolution Algorithm: Distribution of jobs in a system; Convolution algorithm for computing G(N); Computing performance using G(N); Timesharing systems. Hierarchical decomposition of Large Queuing Networks: Load-dependent service centers; Hierarchical decomposition; Limitations of Queuing Theory.

TEXT BOOKS:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2007.

REFERENCE BOOKS:

1. Paul J. Fortier, Howard E. Michel: Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.
2. Trivedi, KS: Probability and Statistics with Reliability, Queuing and computer science Applications, 2nd Edition, Wiley India, 2001.

WEB ENGINEERING

Subject Code: 12SCN253

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Motivation, Categories of web applications, Characteristics of web applications.
- 2. Requirements Engineering:** Introduction, Fundamentals, RE specifics in web engineering, Principles of RE for web applications, Adapting RE methods to web application development, Outlook.
- 3. Modeling Web Application:** Introduction, Fundamentals, Modeling specifics in web engineering, Modeling requirements, Content modeling, Hypertext modeling, Presentation modeling, Customization modeling, Methods and tools, Outlook.
- 4. Web Application Architectures:** Introduction, Fundamentals, Specifics of web application architectures, Components of a generic web application architecture, Layered architectures, Data-aspect architectures.
- 5. Technology-Aware Web Application Design:** Introduction, Web design from an evolutionary perspective, Presentation design, Interaction design, Functional design, Outlook.
- 6. Technologies for Web Applications:** Introduction, Fundamentals, Client/Server communication on the web, Client side technologies, Document-specific technologies, Server-side technologies, Outlook.
- 7. Testing Web Applications:** Introduction, Fundamentals, Testing specifics in web engineering, Test approaches, Test scheme, Test methods and techniques, Test automation, Outlook.
- 8. Operation and Maintenance of Web Applications:** Introduction, Challenges following the launch of a web application, Content management, Usage analysis, Outlook.

- 9. Web Project Management:** From software project management to web project management, Challenges in web project management, Managing web teams, Managing the development process of a web application, Outlook.
- 10. The Web Application Development Process:** Motivation, Fundamentals, Requirements for a web application development process, Analysis of the rational unified process, Analysis of extreme programming, Outlook.
- 11. Usability of Web Applications:** Motivation, What is usability? What characterizes the usability of web applications? Design guidelines, Web usability engineering methods, Web usability engineering trends, Outlook.
- 12. Performance of Web Applications:** Introduction, What is performance? What characterizes performance of web applications, System definition and indicators, Characterizing the work load, Analytical techniques, Representing and interpreting results, Performance optimization methods, Outlook.
- 13. Security for web Applications:** Introduction, Aspects of security, Encryption, digital signatures, and certificates, Secure Client/Server interaction, Client security issues, Service provider security issues, Outlook.
- 14. The Semantic Web:** Fundamentals of the semantic web, Technological concepts, Specifics of semantic web applications, Tools, Outlook.

Text Book:

1. Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzgeer (Editors): Web Engineering, Wiley India, 2007.

Reference Books:

1. Roger Pressman, David Lowe: Web Engineering: A Practitioner's Approach, McGraw Hill, 2008.

CLOUD COMPUTING

Subject Code: 12SCN254

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
- 2. Cloud models:** Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public versus private clouds, cloud infrastructure self service.
- 3. Cloud at a service:** Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand.
- 4. Cloud solutions:** Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.
- 5. Cloud offerings:** Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud.
- 6. Cloud management:** Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.
- 7. Cloud virtualization technology:** Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center.
- 8. Cloud and SOA:** SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

TEXT BOOKS:

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011.

Reference Books

1. Michael Miller, Cloud Computing: Web based applications that change the way you work and collaborate online, Que publishing , August 2009.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On Demand computing applications and data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

WEB-COMMERCE

Subject Code: 12SCN255

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. E-commerce in Indian business context:** Definition of e-commerce advantages of e-commerce, disadvantages of e-commerce, e-commerce opportunities for industries, e-transition challenges for Indian corporate.
- 2. Business models for e-commerce:** e-business models based on relationship of transaction parties – B2C, B2B, C2C and C2B; e-business models based on relationship of transaction types – Brokerage model, Aggregator model, Info-mediary model, community model, value chain model, advertising model, subscription model.
- 3. Enabling Technologies of www :** Internet client-server applications, Networks and Internets, IPV4, IPV6, Search Engines, software agents, Internet standards and specifications, ISP, Broadband technologies – types of broadband technology.
- 4. E-marketing:** Traditional marketing, identifying web-presence goods, Browsing behavior model, online marketing, e-advertising, e-branding, Marketing strategies.
- 5. E-payment Systems:** Main concerns in Internet banking, Digital payment, requirements, Digital token based e-payment systems, classification of new payment systems, Properties of e-cash, cheque payment on Internet, Risk of e-payment systems, Designing e-payment systems, digital signatures.
- 6. Other issues:** E-CRM solutions; e-supply chain management – strategic advantage, ESCM components; Information and Strategy – The virtual value chain, seven dimensions of e-commerce strategy.

Text Books

1. P.T. Joseph, S.J. *“E Commerce – and Indian perspective”* – Third edition, PHI 2010. Ch. 1,2,3,4,6 and related sections of 7,8 and 9 only.
2. Ravi Kalakota and Andrew Winston *“Frontiers of E-commerce”* 12th edition, Pearson Education, 2004.

NETWORK MANAGEMENT

Subject Code: 12SCN31

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards-Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.
- 2. Basic Foundations: Standards, Models, and Language:** Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model
- 3. SNMPv1 Network Management:** Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

- 4. SNMP Management – RMON:** Remote Monitoring, RMON SMI and MIB, RMON1-RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.
- 5 . Broadband Network Management:** Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.
- 6. Network Management Applications:** Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Elective – III

12SCN321	Protocols Engineering
12SCN332	Advances in Digital image processing
12SCN323	Advances in Storage Area Networks

PROTOCOLS ENGINEERING

Subject Code: 12SCN321

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

- 1. Introduction:** Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases
- 2. Error Control, Flow Control:** Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance
- 3. Network Reference Model:** Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.
- 4. Protocol Specification:** Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.
- 5. Protocol Specification Language (SDL):** Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP Multi Protocol Label Switching SDL components.
- 6. Protocol Verification / Validation:** Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL

Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol

Validation: ABP Validation.

7. Protocol Conformance and Performance Testing: Conformance Testing

Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing Multimedia Systems, quality of service test architecture(QOS), Performance Test methods, SDL Based Performance Testing of TCP, OSPF, Interoperability testing, Scalability testing protocol synthesis problem

8. Protocol Synthesis and Implementation: Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis, Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS.

TEXT BOOKS:

1. Pallapa Venkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.

REFERENCE BOOKS:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

TOPICS IN MULTIMEDIA COMMUNICATIONS

Subject Code: 12SCN322

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

- 1. Introduction to Multimedia Communications:** Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework.
- 2. Framework for Multimedia Standardization:** Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards.
- 3. Application Layer:** Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.
- 4. Middleware Layer:** Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.
- 5. Network Layer:** Introduction, QoS in Network Multimedia Systems.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.
3. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Volume 1-Media Coding and Content Processing, 2nd Edition, Pearson, 2003.
4. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

ADVANCES IN STORAGE AREA NETWORKS

Subject Code: 12SCN323

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access.

2. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

3. I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

4. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

5. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

6. Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

7. SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

8. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

9. Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2007.

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
2. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2003.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006

Elective – IV

12SCN331	Wireless Sensor Networks
12SCN332	Advances in Digital image processing
12SCN333	Topics in Analysis of Computer Networks

WIRELESS SENSOR NETWORKS

Subject Code: 12SCN331

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Unique Constraints and Challenges, Advantages of Sensor Networks, Energy advantage, Detection advantage, Sensor Network Applications, Habitat monitoring, Wildlife conservation through autonomous, non-intrusive sensing, Tracking chemical plumes, Ad hoc, just-in-time deployment mitigating disasters, Smart transportation: networked sensors making roads safer and less congested, Collaborative Processing.

2. Key Definitions and The Problem: Key Definitions of Sensor Networks, Canonical Problem: Localization and Tracking, Tracking Scenario, Problem Formulation, Sensing model, Collaborative localization, Bayesian state estimation, Distributed Representation and Inference of States, Impact of choice of representation, Design desiderata in distributed tracking, Tracking Multiple Objects, State space decomposition, Data association, Sensor Models, Performance Comparison and Metrics.

3. Networking and Protocols: Networking Sensors, Key Assumptions, Medium Access Control, The SMAC Protocol, IEEE 802.15.4 Standard and ZigBee, General Issues, Geographic, Energy-Aware Routing, Unicast Geographic Routing, Routing on a Curve, Energy-Minimizing Broadcast, Energy- Aware Routing to a Region, Attribute-Based Routing, Directed Diffusion, Rumor Routing, Geographic Hash Tables. Infrastructure Establishment, Topology Control, Clustering, Time Synchronization, Clocks and Communication Delays, Interval Methods, Broadcasts, Localization and Localization Services, Ranging Techniques, Range-Based Localization Algorithms, Other Localization Algorithms, Location Services. Sensor Tasking and Control, Task-Driven Sensing, Roles of Sensor Nodes and Utilities, Information- Based Sensor Tasking, Sensor selection, IDSQ: Information-driven sensor querying, Cluster leader based protocol, Sensor tasking in tracking relations, Joint Routing and Information Aggregation, Moving center of

aggregation, Multi-step information-directed routing, Sensor group management, Case study: Sensing global phenomena.

4. Databases: Sensor Network Databases, Sensor Database Challenges, Querying The Physical Environment, Query Interfaces, Cougar sensor database and abstract data types, Probabilistic queries, High-level Database Organization, In- Network Aggregation, Query propagation and aggregation, Tiny DB query processing, Query processing scheduling and optimization, Data-Centric Storage, Data Indices and Range Queries, One-dimensional indices, Multidimensional indices for orthogonal range searching, Non-orthogonal range searching, Distributed Hierarchical Aggregation, Multi-resolution, Partitioning, Fractional cascading, Locality preserving hashing, Temporal Data, Data aging, Indexing motion data.

5. Platforms and Tools: Sensor Network Platforms and Tools, Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms, Operating system: Tiny OS, Imperative language: nesC, Dataflow style language: Tiny GALS, Node-Level Simulators, ns-2 and its sensor network extensions, TOSSIM, Programming Beyond Individual Nodes: State-centric programming, Collaboration groups, PIECES: A state-centric design framework, Multi-target tracking problem revisited. Applications and Future Directions.

TEXT BOOKS:

1. Feng Zhao, Leonidas Guibas: Wireless Sensor Networks – An Information Processing Approach, Elsevier, 2004.

ADVANCES IN DIGITAL IMAGE PROCESSING

Subject Code: 12SCN332

I.A. Marks: 50

No of Lecture Hrs/Week: 04

Exam hours: 03

Total No of Lecture Hours: 52

Exam Marks: 100

1. Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

2. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

3. Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial

4. Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency- Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.

5. Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.

6. Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color

Segmentation, Noise in Color Images, Color Image Compression.

7. Image Transformation: Discrete Cosine Transforms, Walsh Hadmard Transforms, Wavelet Transforms and Multiprocessing, Background, Multiresolution Expansions, Wavelet Transforms in one Dimension, Wavelet Transforms in Two Dimensions, Wavelet Packets, an overview of Second Generation Wavelet Transforms.

8. Image and Video Compression: Fundamentals, Image Compression Models, Lossless compression Methods: Huffman coding, run length coding, LZ coding, Arithmetic coding, Lossy Compression: Gray level Run length coding, Block truncation coding, vector quantization, Differential predictive coding, Transform coding , Hybrid coding, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 .

9. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.

10. Image Segmentation and Object Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005
2. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997

REFERENCES:

1. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
2. Z. Li and M.S. Drew: Fundamentals of Multimedia, Pearson, 2004.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Procesing, TataMcGraw Hill, 2004.

TOPICS IN ANALYSIS OF COMPUTER NETWORKS

Subject Code: 12SCN333

I.A. Marks: 50

Hours/Week: 04

Exam Hours: 03

Total Hours: 52

Exam Marks: 100

1. Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

2. Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

3. Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

4. Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

5. Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.
2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE
BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND
EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCN11	Wireless Ad-hoc Networks	4	-	3	20	80	100	4
16SCN12	Advances in Computer Networks	4	--	3	20	80	100	4
16SCN13	Information and Network Security	4	--	3	20	80	100	4
16SCN14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCN15X	Course Electives - 1	4	--	3	20	80	100	3
16SCN16	Computer Networks and Information Security Laboratory	--	3 (2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCN17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives I	
16SCN153	Multi Core Architecture and Programming

WIRELESS AD-HOC NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI251 / 16SCE421 / 16SCN11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamental principles of Ad-hoc Networks • Discuss a comprehensive understanding of Ad-hoc network protocols • Outline current and emerging trends in Ad-hoc Wireless Networks. • Analyze energy management in ad-hoc wireless networks. 			
Module -1			Teaching Hours
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.			10Hours
Module -2			10 Hours
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.			
Module – 3			10 Hours
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.			
Module-4			10 Hours
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks.			
Module-5			10 Hours
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.			
Course outcomes:			
The students shall able to:			
<ul style="list-style-type: none"> • Design their own wireless network • Evaluate the existing network and improve its quality of service • Choose appropriate protocol for various applications • Examine security measures present at different level 			

- Analyze energy consumption and management

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – I

Subject Code	16SCN12/16SCS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss with the basics of Computer Networks.
- Compare various Network architectures.
- Discuss fundamental protocols.
- Define and analyze network traffic, congestion, controlling and resource allocation.

Module 1	Teaching Hours
<p>Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4</p>	10 Hours
<p>Module 2</p> <p>Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2,</p>	10 Hours
<p>Module 3</p> <p>Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18.</p>	10 Hours
<p>Module 4</p> <p>End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3</p>	10 Hours
<p>Module 5</p> <p>Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8</p>	10 Hours
Course Outcomes	
The students should be able to:	

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014.

Reference Books:

1. Uyles Black, “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI.
2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill.

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI12/16SCN13/16SCS253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Teaching Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm			10 Hours
Module 2			
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.			10 Hours
Module 3			
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.			10 Hours
Module 4			
Wireless network security: Wireless security, Wireless network threats, Wireless			10 Hours

<p>network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol</p>	
<p>Module 5</p>	
<p>Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. William Stallings, Cryptography and Network Security, Pearson 6th edition.</p>	
<p>Reference Books: 1. V K Pachghare: Cryptography and Information Security.</p>	

PROBABILITY STATISTICS AND QUEUING THEORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16LNI14 / 16SCN14/16SCS14/ 16SSE14 / 16SIT14 /16SCE14 / 16SFC14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing.
- Apply above concepts in Engineering and Technology.
- Acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Module 1	Teaching Hours
Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	10 Hours

Module 2	Teaching Hours
Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	10 Hours

Module 3	Teaching Hours
Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	10 Hours

Module 4	Teaching Hours
Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, χ^2 – test for goodness of fit, χ^2 test for Independence	10 Hours

Module 5	Teaching Hours
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	10 Hours

Course Outcomes

The students should be able to:

- Demonstrate use of probability and characterize probability models using probability mass (density) functions & cumulative distribution functions.
- Explain the techniques of developing discrete & continuous probability distributions and its applications.
- Describe a random process in terms of its mean and correlation functions.
- Outline methods of Hypothesis testing for goodness of fit.
- Define the terminology & nomenclature appropriate queuing theory and also distinguish various queuing models.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India ,2004.
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI253 /16SCE253 / 16SCN151 /16SCS24 /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			8 Hours
Module -2			8 Hours
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP), IPSO			8 Hours
Module – 3			8 Hours
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.			8 Hours
Module-4			8 Hours
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.			8 Hours
Module-5			8 Hours
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.			8 Hours
Course outcomes:			
At the end of this course the students will be able to: <ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business 			

- Understand the practical knowledge through different case studies
- Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

SOCIAL NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCN152 / 16SIT252/	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> The learning objective of the course Social Network Analysis is to discuss essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks. 			
Module 1			Teaching Hours
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.			8 Hours
Module 2			
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.			8 Hours
Module 3			
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.			8 Hours
Module 4			
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low - dimensional projections			8 Hours
Module 5			
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> Define notation and terminology used in network science. Demonstrate, summarize and compare networks. Explain basic principles behind network analysis algorithms. Analyzing real world network. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R)". Springer, 2014. 			

3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books:

1. NIL

MULTI-CORE ARCHITECTURE AND PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - I

Subject Code	16SCE24 / 16SCN153	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

Module -1	Teaching Hours
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Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.	8 Hours
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Module -2	
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Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features	8 Hours
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Module – 3	
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Threading APIs :Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.	8 Hours
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Module-4	
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OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance	8 Hours
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Module-5	
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Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache	8 Hours
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<p>Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.</p>	
<p>Course outcomes:</p>	
<p>The students shall be able to:</p> <ul style="list-style-type: none"> • Identify the limitations of ILP and the need for multicore architectures • Define fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Make out the salient features of different multicore architectures and how they exploit parallelism • Demonstrate the role of OpenMP and programming concept 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006 	
<p>Reference Books: NIL</p>	

SOFT COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SSE41 / 16SCS254 / 16SCN154	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain key aspects of soft computing. • Identify the components and building block hypothesis of Genetic algorithm. • Analyze Neuro Fuzzy modeling and control. • Evaluate machine learning through Support vector machines. 			
Module 1			Teaching Hours
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.			8 Hours
Module 2			
Perceptron Network: Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).			8 Hours
Module 3			
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.			8 Hours
Module 4			
Defuzzification: Fuzzy decision making, and applications.			8 Hours
Module 5			
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Implement machine learning through neural networks. • Design Genetic Algorithm to solve the optimization problem. • Develop a Fuzzy expert system. • Model Neuro Fuzzy system for clustering and classification. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, ISBN 13: 788126527410, 2011			
Reference Books:			
1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.			

COMPUTER NETWORKS AND INFORMATION SECURITY LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SCN16	IA Marks	20
Number of Lecture Hours/Week	01+03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonste Concepts of fundamental protocols.
- Illustrate internetworking concepts.
- Implement concepts in congestion control and error detections.
- Evaluate fundamentals of Cryptography through practical implementation.
- Implement standard algorithms used to provide confidentiality, integrity and authenticity.
- Design security applications in the field of Information technology.

PART – A Computer Network LABORATORY WORK

Note:

Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

Simulation Programs using OPNET /NS2/NS3 or any other equivalent software

8. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
9. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

PART – B INSLABORATORY WORK

2. Consider a file with composite data, substitute the content and transpose the ciphers.
3. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
4. Apply the RSA algorithm on a text file to produce cipher text file.
5. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
6. Implementation of Message Authentication Code using cryptography VMAC function.
7. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change

- in the input results in a substantial change in the output
- Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN (Sub-netting).

Course Outcomes

The students should be able to:

- Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Design and evaluate application layer protocol
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Conduction of Practical Examination:

- All laboratory experiments (nos) are to be included for practical examination.
- Students are allowed to pick one experiment from **each part and execute both**
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- PART –B:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

SEMINAR [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCE17 / 16SCN17 / 16LNI17 / 16SIT17 / 16SSE17 / 16SCS17 / 16SFC17	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-
CREDITS – 01			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
<p>The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:</p> <ol style="list-style-type: none"> 1. IEEE Transactions, journals, magazines, etc. 2. ACM Transactions, journals, magazines, SIG series, etc. 3. Springer 4. Elsevier publications etc <p>In the area of (to name few and not limited to)</p> <ul style="list-style-type: none"> • Web Technology • Cloud Computing • Artificial Intelligent • Networking • Security • Data mining 			
Course Outcomes			
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Conduct survey on recent technologies • Infer and interpret the information from the survey conducted • Motivated towards research 			
Conduction:			
<p>The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.</p>			
<p>Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).</p>			

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM
(CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16SCN21	Multimedia Communications	4	--	3	20	80	100	4
16SCN22	Cloud Computing	4	--	3	20	80	100	4
16SCN23	Network Management	4	--	3	20	80	100	4
16SCN24	Managing Big Data	4	--	3	20	80	100	4
16SCN25x	Course Electives – II	4	--	3	20	80	100	3
16SCN26	Mini-project	--	3 hrs lab	3	20	80	100	2
16SCN27	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Elective II

16SCN252 Wireless Sensor Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

III SEMESTER: Internship

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16SCN32	Report on Internship	-	-	-	25	-	25	
3	16SCN33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16SCN34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech (Computer Network Engineering)

IV SEMESTER

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16SCN41	Client Server Programming	4	-	3	20	80	100	4
2	16SCN42x	Course Electives-III	3	-	3	20	80	100	3
3	16SCN43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16SCN44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			7	-	6	90	360	450	20

Elective

16SCN421 Service Oriented Architecture

Note:

- 1. Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/visit industries to finalize the topic of Project.
- 2. Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
- 3. Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
- 4. Project evaluation:**
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks

MULTIMEDIA COMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN21/16LNI152	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the Multimedia Communication Models • Explain Multimedia Transport in Wireless Networks • Solve the Security issues in multimedia networks • Illustrate real-time multimedia network applications. • Explain different network layer based application. 			
Module 1			Teaching Hours
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,. Text, images, audio and video.			10 Hours
Module 2			
Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG			10 Hours
Module 3			
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.			10 Hours
Module 4			
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.			10 Hours
Module 5			
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Deploy the right multimedia communication models. • Apply QoS to multimedia network applications with efficient routing techniques. • Solve the security threats in the multimedia networks. • Develop the real-time multimedia network applications 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Fred Halsall, “Multimedia Communications”, Pearson education, 2001. 2. Raif Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson education, 2002. 			

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCS12/16SCE12 16SIT22/16SSE254 16SCN22/16LNI151	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define and Cloud, models and Services. • Compare and contrast programming for cloud and their applications • Explain virtualization, Task Scheduling algorithms. • Apply ZooKeeper, Map-Reduce concept to applications. 			
Module 1			Teaching Hours
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.			10 Hours
Module 2			
Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.			10 Hours
Module 3			
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems			10 Hours
Module 4			
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.			10 Hours
Module 5			
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine			10 Hours

<p>monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.</p>	
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Compare the strengths and limitations of cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Apply suitable virtualization concept. • Choose the appropriate cloud player • Address the core issues of cloud computing such as security, privacy and interoperability • Design Cloud Services • Set a private cloud 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.</p>	
<p>Reference Books: 1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. 2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.</p>	

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI154 / 16SCN23	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate need for interoperable network management. • Explain the concepts and architecture behind standards based network management. • Illustrate the concepts and terminology associated with SNMP and TMN • Demonstrate network management as a typical distributed application 			
Module 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards-Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions-Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			10 Hours
Module 2			10 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			10 Hours
Module 3			10 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			10 Hours
Module 4			10 Hours
Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL			10 Hours

Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	10 Hours
Course Outcomes	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books: 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.			10Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.			10 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS 			

- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN251	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain switching and multiplexing. • Analyze the transmission technology. And transmission control. • Demonstrate basic knowledge on telecommunication 			
Module -1			Teaching Hours
Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks			8 Hours
Module -2			
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization			8 Hours
Module – 3			
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing			8 Hours
Module-4			
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching			8 Hours
Module-5			
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems			8 Hours
Course outcomes:			
The student will be able to: <ul style="list-style-type: none"> • Explain basics of telecommunications and digital form • Elaborate switching and multiplexing, telecommunication. • Illustrate transmission control in telecommunication • Design and develop switching, multiplexing and traffic control. 			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • There will be 2 questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 			

Text Books:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Reference Books:

WIRELESS SENSOR NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN252	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain sensor networks for various application setups. • Demonstrate the design space and conduct trade-off analysis between performance and resources. • Assess coverage and conduct node deployment planning. • Devise appropriate data dissemination protocols and model links cost. • Determine suitable medium access protocols and radio hardware. • Illustrate sensor networks using commercial components. • Discuss quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints. 			
Module -1			Teaching Hours
Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. (Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)			8 Hours
Module -2			Teaching Hours
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies (Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)			8 Hours
Module – 3			Teaching Hours
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. (Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)			8 Hours
Module-4			Teaching Hours
Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware. (Chapter 7: 7.1-7.4, Chap. 8: 8.1-8.4)			8 Hours
Module-5			Teaching Hours
Network Management and Operating System for Wireless Sensor Networks: Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. (Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)			8 Hours
Course outcomes:			

The students shall able to:

- Explain existing applications of wireless sensor actuator networks
- Apply in the context of wireless sensor networks and explain elements of distributed computing and network protocol design
- Contrast Various hardware, software platforms that exist for sensor networks
- Summarize various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:", WILEY , Second Edition (Indian) , 2014

Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

OPTICAL NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define basic elements of optical fiber transmission link, fiber modes configurations and structures • Compare different kind of losses, signal distortion in optical wave guides and other signal degradation factors • List and explain various optical source materials, LED structures, quantum efficiency, and Laser diodes • Demonstrate fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration and also fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM 			
Module -1			Teaching Hours
Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.			8 Hours
Module -2			
WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.			8 Hours
Module – 3			
Control and Management: Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. Configuration Management: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol			8 Hours
Module-4			

<p>Basic Concepts: Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCh-Mesh Protection, GMPLS Protection, Interworking between Layers.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model, Maximum Load Dimensioning Models: Offline Light path Requests, Online RWA in Rings</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Explain fundamentals of optical network. • Analyze optical network architectures ranging from optical access networks to backbone optical transport networks. • Choose approaches and methodologies of optical network for design effective optimization; • Apply Techniques of optical network survivability. • Demonstrate problem solving skills and critical thinking in the discipline of optical networks. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <p>1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.</p>	
<p>Reference Books:</p> <p>1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.</p>	

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI23/ 16SCE23 16SCN254 / 16SIT23	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Analyze system requirements for mobile applications. • Apply of mobile development frameworks. • Demonstrate mobile application design. • Demonstrate and implement mobile application. 			
Module -1			Teaching Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.			8 Hours
Module -2			
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.			8 Hours
Module – 3			
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API.			8 Hours
Module-4			
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.			8 Hours
Module-5			
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications			8 Hours
Course outcomes:			
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Mobile Computing: (technologies and Applications-N. N. Jani S chand
2. B.M.Hirwani- Android programming Pearson publications-2013
3. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26 / 16SIT26 / 16SSE26	IA Marks	20
Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
<p>The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.</p>			
<p>Course outcomes:</p> <ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
<p>Conduction of Practical Examination:</p> <p>The student shall prepare the report by including:</p> <ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
<p>Evaluation:</p> <p>Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20</p>			

= 80 marks.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – II

Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-

CREDITS – 01

Course objectives: This course will enable students to

- Motivate the students to read technical article
- Discover recent technology developments

Descriptions

The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

CLIENT SERVER PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SIT151 / 16LNI41 / 16SCN41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/o. • Define System Calls, Basic I/O Functions available in UNIX • Illustrate socket interface, TCP, UDP in detail. • Compare various client Software and various algorithms issue related to server software design. 			
Module 1			Teaching Hours
The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. Program Interface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.			10 Hours
Module 2			
The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.			10 Hours
Module 3			
Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.			10 Hours
Module 4			
Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs			10 Hours

<p>Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.</p>	
<p>Module 5</p>	
<p>Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/O. • Demonstrate programming System Calls, Basic I/O Functions available in UNIX • Implement Socket interface, TCP, UDP in detail. • Compare and contrast Client Software Various applications and their issues 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. NIL 	

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SSE13 /16SIT153 / 16SCN421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Interpret various architecture for application development • Demonstrate the importance of SOA in Application Integration • To learn web service and SOA related tools • To Learn implementation details of SOA • To understand various case studies 			
Module 1			Teaching Hours
SOA BASICS :Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models.			8 Hours
Module 2			
SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings.			8 Hours
Module 3			
SOA GOVERNANCE: SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software as a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices.			8 Hours
Module 4			
SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB Data binding.			8 Hours
Module 5			
APPLICATION INTEGRATION: JAX –WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Compare different IT architecture • Analyze and design of SOA based applications • Implement web service and realize of SOA • Implement REST full services • Design and implement of SOA based Application Integration using BPEL 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley 2008.

Reference Books:

1. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.
2. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

ANALYSIS OF COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain with the concepts of computer networks • What is a computer network and what are the fundamental protocols. • Analyze network architectures in stochastic and deterministic way. • Illustrate RSVP, Principles of TCP • Discover more on different network protocols. • Explain multiplexing, streaming sessions in computer network. 			
Module -1			Teaching Hours
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.			8 Hours
Module -2			
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.			8 Hours
Module – 3			
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).			8 Hours
Module-4			
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic			8 Hours
Module-5			
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive			8 Hours

Window Protocol; Bandwidth sharing in a Network.	
Course outcomes:	
On completion, student will be able to:	
<ul style="list-style-type: none"> List and classify network services, protocols and architectures, explain why they are layered. Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.	
Reference Books:	
1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.	
2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999	

NETWORK ROUTING ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> Discuss layered architecture for communication networks and the specific functionality of the network layer. Explain the basic principles of routing and the manner, this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network. Compare and contrast different routing algorithms existing and their performance characteristics. 			

Module -1	Teaching Hours
<p>NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits.</p> <p>Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra’s Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm</p> <p>Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost</p>	8 Hours
Module -2	
<p>ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution</p> <p>OSPF and Integrated IS-IS :From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF</p> <p>Internet Routing Architectures: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability</p>	8 Hours
Module – 3	
<p>Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. IP Address Lookup Algorithms: Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. IP Packet Filtering and Classification: Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.</p>	8 Hours
Module-4	
<p>ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, Ad hoc routing, Mesh routing, Vehicular routing, Sensor routing</p>	8 Hours
Module-5	

<p>TOWARD NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing</p> <p>MPLS and GMPLS: Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. Routing and Traffic Engineering with MPLS: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. VoIP Routing: Interoperability through IP and PSTN : PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<ul style="list-style-type: none"> • Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance. • The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Deepankar Medhi and Karthikeyan Ramasamy, “Network Routing: Algorithms, Protocols, and Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007 2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons, Inc, © ISTE Ltd 2014 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002. 2. M. Steen Strub, “Routing in Communication network,” Prentice –Hall International, Newyork, 1995. 3. James D. McCabe, “Network Analysis, Architecture, and Design”, 3rd Edition, 2007 Elsevier Inc. 	

WEB MINING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN424	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Compare and contrast different knowledge discovery issues in Web mining. • Analyze the different algorithms commonly used by Web application. • Apply the role played by Web mining in Information retrieval and extraction • Demonstrate the documents structures and grouping, • Use the probabilistic model for web mining • Illustrate applications using Web mining 			
Module -1			Teaching Hours
<p>INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining . INFRASTRUCTURE and WEB SEARCH -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search.</p>			8 Hours
Module -2			
<p>INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction</p>			8 Hours
Module – 3			
<p>LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding’s – Probabilistic Approaches to clustering – Collaborative Filtering, SUPERVISED LEARNING: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection.</p>			8 Hours
Module-4			

<p>LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISED LEARNING-- Expectation Maximization, Labeling Hypertext Graphs and Co- training.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> • Identify the application areas for web content mining, web structure mining and webusage mining. • Design to retrieval the web data • Develop schemes to crawl the web data, organize and index • Cluster the documents for fast access • Develop algorithms used by web mining applications. • Select between different approaches and techniques of web mining 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sholom Weiss, “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005 2. Soumen Chakrabarti, “Mining the Web: Discovery Knowledge from Hypertext Data,” Elsevier Science 2003 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Min Song, Yi-fang Brok Wu, “Handbook of Research on Text and Web Mining Technologies”, Vol I & II, Information Science Reference (IGI), 2009 2. K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining Theory and Practice ,” Prentice Hall of India Private Ltd 2006 3. Anthony Scime, “Web Mining Applications and Techniques”, Idea Group Publishing,2005 4. Margret H.Dunham “DATA MINING - Introductory and Advanced Concepts”, PearsonEducation,2003. 	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / FieldWork / Assignment / Tutorials		I.A.	Exam		
14SCN11	Wireless Adhoc Networks	4	2 *	03	50	100	150	4
14SCN12	Advanced in Computer Networks	4	2 *	03	50	100	150	4
14SCN13	Information and Network Security	4	--	03	50	100	150	4
14SCN14	Advanced in Storage Area Network	4	2	03	50	100	150	4
14SCN15x	Elective – I	4	2	03	50	100	150	4
14SCN16	Information and Network Security Laboratory	0	3	03	25	50	75	2
14SCN17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I

14SCN152 Computer Systems Performance Analysis

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH (COMPUTER NETWORK ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14SCN21	Multimedia Communications	4	2 *	03	50	100	150	4
14SCN22	Distributed Computing	4	--	03	50	100	150	4
14SCN23	Network Management	4	2 *	03	50	100	150	4
14SCN24	Switching & Statistical Multiplexing In Telecommunications	4	2	03	50	100	150	4
14SCN25 _x	Elective – II	4	2	03	50	100	150	4
14SSCN26	Distributed Computing Laboratory	0	3	03	25	50	75	2
14SCN27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCN252 Wireless Sensor Networks

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	--	--	-	25	--	25	1
14SCN32	Report on Internship	--	--	-	--	75	75	15
14SCN33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	--	--	3	25	125	150	20

ELECTIVE- III

14SCN422

Service Oriented Architecture

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS	
		Lecture	Fieldwork / Assignment / Tutorials		I.A.	Exam			
14SCN41	Client Server Programming *	4	2 *	03	50	100	150	4	
14SCN42x	Elective-III	4	2	03	50	100	150	4	
14SCN43	Evaluation of Project Phase-II	0	--	--	25	--	25	1	
14SCN44	Evaluation of Project Phase-III	0	--	--	25	--	25	1	
14SCN45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	150	18	
Total		08	07	09	150	400	550	28	
Grand Total (I to IV Sem.)		Marks: 2400; Credits : 94							

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or technical paper.

1).Project Phase – I : 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase – III : Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be $50+50+100=200$ (50 Marks for Internal Guide, 50 Marks for External and 100 for Viva-Voce)

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Course Title: Wireless Ad-hoc Networks	Course Code: 14SCN11
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To explore the design space and conduct trade-off analysis between performance and resources.
- To Determine suitable medium access protocols and radio hardware.
- To learn Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- To explore the Ad-hoc network concepts by using network simulators.

TOPICS

MODULE I

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet;
MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas
 (Chapter 5: 5.1-5.3, Chapter 6: 6.1-6.8) **10 Hours**

MODULE II

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols
 (Chapter 7: 7.1-7.6, 7.8, 7.9) **10 Hours**

MODULE III

Multicast Routing in Ad hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
 (Chapter 8: 8.1-8.7) **10 Hours**

MODULE IV

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad hoc Wireless Networks.
 (Chapter 9: 9.1-9.6, 9.7-9.12) **10 Hours**

MODULE V

Quality of Service and Energy Management in Ad hoc Wireless Networks

Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

(Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6)

10 Hours

LABORATORY WORK

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.
- 2: Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.
4. Develop and Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.
5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

COURSE OUTCOMES

Students will be able to

- Apply knowledge of wireless Ad-hoc networks to various application areas.
- Design, implement and maintain wireless Ad-hoc networks.
- Formulate and solve problems creatively.
- Practical knowledge acquired by hands-on session.

TEXT BOOKS:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

Semester I

Year: 2014-2015

Course Title: Advances in Computer Networks	Course Code: 14SCN12
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To become familiar with the basics of Computer Networks.
- To learn Network architectures.
- To learn Concepts of fundamental protocols.
- To gain the knowledge of internetworking concepts.
- To understand the knowledge of internetworking concepts in various applications.
- To acquire knowledge of implementation concepts in congestion control and error detections.

TOPICS

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1:Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2:Chapter 4

10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2.

10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

T1: Chapter 3.3, 4.1.1, 4.1.3 **T2:** Chapter 13.1 to 13.18 , Chapter 18.

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3

10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP) .

T1: Chapter 6.4 **T2:** Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8

10 Hours

LABORATORY WORK

PART A: Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

COURSE OUTCOMES

Students will be able to

- Classify network services, protocols and architectures, explain why they are layered.
- Knowledge on key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Practical knowledge gained by hands-on sessions.
- Gain the knowledge of application layer protocol.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier - 2014
2. **T2: Douglas E Comer,** “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Inte rfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill.

Semester I

Year: 2014-2015

Course Title: Information and Network Security	Course Code: 14SCN13
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

TOPICS

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, ..

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer** :SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication

plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

References

1. V k Pachghare: Cryptography and Information Security. PHI Learning. ISBN 978-81-203-3521-9

Semester I

Year: 2014-2015

Course Title: Advances in Storage area Network	Course Code: 14SCN14
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre’s maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems
- To appreciate the use of cables technologies used in SAN technology.

TOPICS

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **10 Hours**

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **10 Hours**

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network;

Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Have Knowledge on various RAID levels.
- Apply the techniques used for data maintenance.
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Semester I

Year: 2014-2015

Course Title: Advanced algorithms	Course Code: 14SCN151
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To get an awareness of probabilistic and randomize algorithms.

TOPICS

MODULE I

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

COURSE OUTCOMES:

The students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Get knowledge about different application based algorithm.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Course Title: Computer Systems Performance Analysis	Course Code: 14SCN152
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To understand the concept of planning and design in computer system.

TOPICS

TOPICS:

MODULE I

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

10 Hours

MODULE II

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

10 Hours

MODULE III

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

10 Hours

MODULE IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. **Experimental Design and Analysis: Introduction:** Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

10 Hours

MODULE V

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow

Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Define Little's law and other operational laws
- Apply the operational laws to open and closed systems
- Use discrete-time and continuous-time Markov chains to model real world systems
- Develop analytical techniques for evaluating scheduling policies

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Semester I

Year: 2014-2015

Course Title: Multi-core Architecture and Programming	Course Code: 14SCN153
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multi core architectures
- To expose the students to warehouse-scale and embedded architectures

TOPICS

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

10 Hours

MODULE II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours

MODULE III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours

MODULE IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006.

Semester I

Year: 2014-2015

Course Title: Soft Computing	Course Code: 14SCN154
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

Topics:

MODULE I

Introduction to Soft computing, Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model. **10 Hours**

MODULE II

Perceptron Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propogation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models) **10 Hours**

MODULE III

Introduction to classical sets and fuzzy sets, Classical relations and fuzzy relations, Membership functions, **10 Hours**

MODULE IV

Defuzzification, Fuzzy decision making, and applications **10 Hours**

MODULE V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA
General genetic algorithms, The schema theorem, Genetic programming, applications

10 Hours

Course Outcomes:

The student will be able to:

- Implement machine learning through neural networks.

- Write Genetic Algorithm to solve the optimization problem
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.

Text book:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, Jun-2007
(Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

Reference Books:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, PHI (EEE edition) ISBN: 978-81-203-2243-1

Semester I

Year: 2014-2015

Course Title: Information and Network security Lab	Course Code: 14SCN16
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives:

- To understand the fundamentals of Cryptography through practical implementation.
- To implement standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to use cutting edge simulation tools
- To design security applications in the field of Information technology.

LABORATORY WORK

Note: Use C/C++/Java or equivalent tool to implement the following experiment

1. Consider a file with composite data, substitute the content and transpose the ciphers.
2. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
3. Apply the RSA algorithm on a text file to produce cipher text file.
4. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
5. Implementation of Message Authentication Code using cryptography VMAC function.
6. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output
7. Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN [Subnetting].
8. Develop a mechanism to setup(configure) a port scanner and identify the intrusion.

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Semester II

Year: 2014-2015

Course Title: Multimedia Communications	Course Code: 14SCN21
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

Course Objectives:

- To understand the Multimedia Communication Models
- To study the Multimedia Transport in Wireless Networks
- To solve the Security issues in multimedia networks
- To explore real-time multimedia network applications.
- To explore different network layer based application.

TOPICS

MODULE I

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework. **10 Hours**

MODULE II

Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards. **10 Hours**

MODULE III

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access. **10 Hours**

MODULE IV

Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution. **10 Hours**

MODULE V

Network Layer: Introduction, QoS in Network Multimedia Systems. **10 Hours**

LABORATORY WORK

The following experiments should be practiced (Tools such as HTML/Frontpage/Dreamweaver/ equivalent, Multimedia application enabling software ,System software support for multimedia, Performance measurement tools for multimedia ,Multimedia authoring tools, Web tools and applications)

1. Audio and video editing
2. Image editing
3. 2D and 3D animation.

.The case studies are:

- Video on-demand
- Interactive TV
- Home shopping
- Remote home care
- Electronic album
- Personalized electronic journals.

COURSE OUTCOMES:

Students will be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network applications.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

Semester II

Year:2014-2015

Course Title: Distributed Computing	Course Code: 14SCN22
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To learn Basic Concepts of DSM, Hardware DSM
- To understand File Sharing, DFS Implementation, Replication in DFS,
- To understand the concepts of Cryptanalysis, Secure channels, Access control.
- To understand some of the security concepts in distributed computing.

TOPICS

MODULE I

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

10 hours

MODULE II

Distributed Shared Memory :Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

10 hours

MODULE III

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies. **Naming**: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

10 hours

MODULE IV

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies.

10 hours

MODULE V

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS. **Emerging Trends in distributed Computing**: Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

10 hours

COURSE OUTCOMES:

The student will be able to

- Realize shared memory concept.
- Realize Advantages of DFS.
- Implement mechanisms to manage security in DS

Text Book.

1. Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010

Semester II

Year:2014-2015

Course Title: Network Management	Course Code: 14SCN23
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the need for interoperable network management.
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP and TMN.
- To understand network management as a typical distributed application

TOPICS

MODULE I

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. **10 Hours**

MODULE II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. **10 Hours**

MODULE III

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model
SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. **10 Hours**

MODULE IV

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles. **10 Hours**

MODULE V

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation

Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **10 Hours**

LABORATORY WORK:

1. Capture packets transferred while browsing a selected website (e.g. a page from the course website, a search engine home page). Investigate the protocols used in each packet, the values of the header fields and the packet sizes.
2. Explore at least the following features of Wireshark: filters, Flow Graphs (TCP), statistics, protocol hierarchies.
3. Create several example files for your Apache web server to serve. Configure your web server, and then ask a friend to test your web server by accessing the files. Capture the packets and observe the log file.
4. Configure authentication for a specific directory on your web server. Test, captured packets and observe the log file.
5. Login to another computer in the lab, capture and investigate the data exchanged.
6. Trace the path between several pairs of source/destination nodes.
7. Create fire wall rule(s) that will drop TCP packets destined to a specific computer on the lab network (e.g. yours neighbors computer).
8. Using the supplied client/server sockets programs, implement a third proxy server.

Note: NS2 or equivalent tool to be used.

Course Outcomes:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Semester II

Year:2014-2015

Course Title: Switching & Statistical Multiplexing in Telecommunications	Course Code: 14SCN24
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand Switching and multiplexing.
- To understand the transmission technology.
- To understand the transmission control.
- To understand basic knowledge on telecommunication.

Topics:

MODULE I

Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. **Why Digital:** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

10 Hours

MODULE II

Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

10 Hours

MODULE III

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. **Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

10 Hours

MODULE IV

Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

10 Hours

MODULE V

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

10 Hours

Course Outcomes:

The student will be able to:

- Gain the knowledge about switching and multiplexing
- Gain the knowledge about telecommunication.
- Learn transmission control in telecommunication.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Semester II

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCN251
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To gain knowledge Virtualization
- To gain knowledge Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- To gain knowledge in cloud resource virtualization and scheduling.

TOPICS:

MODULE I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

MODULE II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

MODULE III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study:Xen a VMM based

paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

MODULE IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

MODULE V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

Course Outcomes:

The student will be able to:

- Demonstrate simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Semester II

Year:2014-2015

Course Title: Wireless Sensor Networks	Course Code: 14SCN252
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.

- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

TOPICS:

MODULE I

Introduction, Overview and Applications of Wireless Sensor Networks

Introduction, Basic overview of the Technology, **Applications of Wireless Sensor Networks:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology

(Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)

10 Hours

MODULE II

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, **Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Available Wireless Technologies

(Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)

10 Hours

MODULE III

MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **Routing Protocols for Wireless Sensor Networks:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

(Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)

10 Hours

MODULE IV

Transport Control and Middleware for Wireless Sensor Networks

Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. **Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

(Chapter 7: 7.1-7.4, Chapter 8: 8.1-8.4)

10 Hours

MODULE V

Network Management and Operating System for Wireless Sensor Networks

Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. **Operating Systems for Wireless Sensor Networks:** Introduction, Operating System Design Issues, Examples of Operating Systems.

(Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)

10 Hours

COURSE OUTCOMES

The student will be able to:

- Develop applications of wireless sensor actuator networks
- Implement the elements of distributed computing and network protocol .

- Explore various hardware, software platforms that exist for sensor networks

TEXT BOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications”, WILEY , Second Edition (Indian) , 2014

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.

Semester II

Year: 2014-2015

Course Title: Optical Networks	Course Code: 14SCN253
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM
- To acquire knowledge about fault and congestion management.

Topics

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel. **10 Hours**

MODULE II

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations. **10 Hours**

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum Load **Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Design a system, component or process as per needs and specification.
- Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
- Gain the knowledge on methodologies of optical network design optimization;
- Explore techniques of optical network survivability.
- Solve the Problems in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advances in VLSI Design and Algorithms	Course Code: 14SCN254
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- Able to understand the fundamentals of CMOS VLSI and associated technologies.
- Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
- Able to appreciate the design process in VLSI, GALS.
- Able to explain basic operation principles of diodes and MOS FPGAs; PLA.
- Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout

TOPICS:**MODULE I**

Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing; Integrated Circuit Design Techniques; IP-Based Design.

Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

10 Hours**MODULE II**

Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

10 Hours**MODULE III**

Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

10 Hours**MODULE IV**

Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

10 Hours**MODULE V**

Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

10 Hours

Course Outcomes:

The student will be able to:

- Clear understanding of important concepts in CMOS technology and fabrication that affect design.
- Apply two-level and multi-level logic minimization techniques to the given Boolean logic function.
- Design and develop Layout a gate in CMOS VLSI technology.

TEXT BOOKS:

1. Wayne Wolf: “Modern VLSI design”, 4th Edition, P HI Learning, 2007.
2. Sabih H Gerez: “Algorithms for VLSI Design Autom ation”, Wiley India, 2007.

Semester II

Year: 2014-2015

Course Title: Distributed Computing Lab	Course Code: 14SCN26
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives

- To understand the main ideas and concepts on web services.
- Studying and working on a related topic of internet applications such as information hiding, system security and E-learning.
- To understand the concepts of UDDI, SOAP, JMS remote procedure calls.

LIST OF EXPERIMENTS:

Note: Use appropriate tools/language to implement the following experiment:

1. Design and implement client server application using RMI (Remote Method Invocation) to invoke a service to calculate the income tax.
2. Design and implement EJB (Entity Java Beans) session bean business logic to calculate income tax and invoke the service using stub, i.e., client side proxy object.
3. Design and implement an EJB entity bean to persist the client submitted data into an enterprise information system.
4. Design and implement an offline database communication system using JMS (Java Message Service) to service the client request.
5. Design and implement the client code to call the Micro soft service like free service from UDDI (Universal Description Discovery Protocol).
6. Design and implement business logic and bind it as service using SOAP (Simple Object Access Protocol), also implement client to call service.

NOTE: Use EJB 3.X or any equivalent tool.

COURSE OUTCOMES:

The student will be able to

- Develop and debug RPC based client-Server programs in UNIX.
- Realize the partial implementation of UDDI, SOAP, JMS in Web applications.

Semester IV

Year: 2014-2015

Course Title: Client-Server Programming	Course Code: 14SCN41
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand **Client-Server software**, Context Switching and Protocol Software, I/o.
- To understand System Calls, Basic I/O Functions available in UNIX
- To understand the Socket interface, TCP, UDP in detail.
- Various client software applications and their issues.
- To understand the concept of Socket interface in client server programming.

TOPICS:

MODULE I

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts
Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP. **10 Hours**

MODULE II

The Socket Interface: Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **10 Hours**

MODULE III

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays,

A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

MODULE IV

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

MODULE V

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

LABORATORY WORK:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Design, develop, and execute a program using JAVA networking facilities to implement a simple Day / Time Server and demonstrate its functioning. Repeat the above problems.

COURSE OUTCOMES

The student will be able to:

- Gain in depth knowledge about Client-Server software, Context Switching and Protocol Software, I/o.
- Programming System Calls, Basic I/O Functions available in UNIX
- Gain the knowledge on Socket interface, TCP, UDP in details.
- Pros and cons of Client Software Various applications and their issues.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Title: Analysis of Computer Networks	Course Code: 14SCN421
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To Become familiar with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- To analyze network architectures in stochastic and deterministic way.
- RSVP, Principles of TCP
- To explore more on different network protocols.
- To understand the knowledge of multiplexing, streaming sessions in computer network.

TOPICS:**MODULE I**

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

10 Hours**MODULE II**

Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

10 Hours**MODULE III**

Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

10 Hours**MODULE IV**

Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

10 Hours**MODULE V**

Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

10 Hours**Course Outcomes:**

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

Semester IV

Year:2014-2015

Course Title: Service Oriented Architecture	Course Code: 14SCN422
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand various architecture for application development
- To understand the importance of SOA in Application Integration
- To learn web service and SOA related tools.
- To learn the concepts of SOA governance.

Topics:

MODULE I

SOA BASICS: Software Architecture – Types of IT Architecture – S OA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architec ture – Enterprise Applications – Solution Architect ure for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models

10 Hours

MODULE II

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Ac tivity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits o f SPA – Cost Savings

10 Hours

MODULE III

SOA GOVERNANCE :SOA implementation and Governance – strategy – SOA d evelopment – SOA governance – trends in SOA – event-driven architect ure – software s a service – SOA technologies – pro of-of-concept – process orchestration – SOA best practice s

10 Hours

MODULE IV

SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL, SOAP and Java/XML mapping in SOA – JAXB Data binding.

10 Hours

MODULE V

APPLICATION INTEGRATION: JAX-WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study – WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Compare the different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Text Book:

1. Shankar Kambhampaly, “Service-Oriented Architecture for Enterprise Applications”, Wiley 2008.

REFERENCES:

2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.
3. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009.

Semester IV

Year: 2014-2015

Course Title: Mobile Application Development	Course Code: 14SCN423
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To Understand system requirements for mobile applications
- To Generate suitable design using specific mobile development frameworks
- To Generate mobile application design
- To Implement the design using specific mobile development frameworks
- To acquire knowledge of android applications development.

Topics:

MODULE I

Introduction to mobile communication and computing:, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover

and security. Smart phone operating systems and smart phones applications.

10 Hours

MODULE II

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control .

10 Hours

MODULE III

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

10 Hours

MODULE IV

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations,

10 Hours

MODULE V

Displaying web pages and maps, communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications.

10 Hours

Course Outcomes:

The student will be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop and design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS

Text Books:

1. Mobile Computing: Technologies and Applications- N. N. Jani S chand,2009.
2. B.M.Hirwani- Android programming Pearson publications-2013

Course Title: Cybercrime and Digital Forensic	Course Code: 14SCN424
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To understand Accounting Forensics
- To analyze the nature and effect of cyber crime in society.
- To understand Sarbanes-Oxley Financial and Accounting Disclosure Information
- To understand Computer Crime and Criminals
- To understand Liturgical Procedures

Topics:**MODULE I**

INTRODUCTION: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

10 Hours**MODULE II**

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

10 Hours**MODULE III**

INVESTIGATION: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

10 Hours**MODULE IV**

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. **10 Hours**

MODULE V

LAWS AND ACTS: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

10 Hours

Course Outcomes

The student will be able to:

- Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.
- Distinguish various types of computer crime, and use computer forensic techniques to identify the digital fingerprints associated with criminal activities.
- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- Develop a custom computer forensic analysis tool.

Text:

1. Nelson Phillips and Einfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw -Hill , New Delhi, 2006.

References:

3. Robert M Slade, “Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE
BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND
EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCN11	Wireless Ad-hoc Networks	4	-	3	20	80	100	4
16SCN12	Advances in Computer Networks	4	--	3	20	80	100	4
16SCN13	Information and Network Security	4	--	3	20	80	100	4
16SCN14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCN15X	Course Electives - 1	4	--	3	20	80	100	3
16SCN16	Computer Networks and Information Security Laboratory	--	3 (2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCN17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives I	
16SCN153	Multi Core Architecture and Programming

WIRELESS AD-HOC NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI251 / 16SCE421 / 16SCN11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamental principles of Ad-hoc Networks • Discuss a comprehensive understanding of Ad-hoc network protocols • Outline current and emerging trends in Ad-hoc Wireless Networks. • Analyze energy management in ad-hoc wireless networks. 			
Module -1			Teaching Hours
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.			10Hours
Module -2			
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.			10 Hours
Module – 3			
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.			10 Hours
Module-4			
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.			10 Hours
Module-5			
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.			10 Hours
Course outcomes:			
The students shall able to:			
<ul style="list-style-type: none"> • Design their own wireless network • Evaluate the existing network and improve its quality of service • Choose appropriate protocol for various applications • Examine security measures present at different level 			

- Analyze energy consumption and management

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – I

Subject Code	16SCN12/16SCS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss with the basics of Computer Networks.
- Compare various Network architectures.
- Discuss fundamental protocols.
- Define and analyze network traffic, congestion, controlling and resource allocation.

Module 1	Teaching Hours
<p>Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4</p>	10 Hours
<p>Module 2</p> <p>Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2,</p>	10 Hours
<p>Module 3</p> <p>Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18.</p>	10 Hours
<p>Module 4</p> <p>End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3</p>	10 Hours
<p>Module 5</p> <p>Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8</p>	10 Hours
Course Outcomes	
The students should be able to:	

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014.

Reference Books:

1. Uyles Black, “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI.
2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill.

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI12/16SCN13/16SCS253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Teaching Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm			10 Hours
Module 2			
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.			10 Hours
Module 3			
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.			10 Hours
Module 4			
Wireless network security: Wireless security, Wireless network threats, Wireless			10 Hours

<p>network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol</p>	
<p>Module 5</p>	
<p>Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. William Stallings, Cryptography and Network Security, Pearson 6th edition.</p>	
<p>Reference Books: 1. V K Pachghare: Cryptography and Information Security.</p>	

PROBABILITY STATISTICS AND QUEUING THEORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16LNI14 / 16SCN14/16SCS14/ 16SSE14 / 16SIT14 /16SCE14 / 16SFC14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing.
- Apply above concepts in Engineering and Technology.
- Acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Module 1	Teaching Hours
Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	10 Hours

Module 2	Teaching Hours
Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	10 Hours

Module 3	Teaching Hours
Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	10 Hours

Module 4	Teaching Hours
Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, χ^2 – test for goodness of fit, χ^2 test for Independence	10 Hours

Module 5	Teaching Hours
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	10 Hours

Course Outcomes

The students should be able to:

- Demonstrate use of probability and characterize probability models using probability mass (density) functions & cumulative distribution functions.
- Explain the techniques of developing discrete & continuous probability distributions and its applications.
- Describe a random process in terms of its mean and correlation functions.
- Outline methods of Hypothesis testing for goodness of fit.
- Define the terminology & nomenclature appropriate queuing theory and also distinguish various queuing models.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India ,2004.
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI253 /16SCE253 / 16SCN151 /16SCS24 /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			8 Hours
Module -2			8 Hours
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP), IPSO			8 Hours
Module – 3			8 Hours
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.			8 Hours
Module-4			8 Hours
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.			8 Hours
Module-5			8 Hours
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.			8 Hours
Course outcomes:			
At the end of this course the students will be able to: <ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business 			

- Understand the practical knowledge through different case studies
- Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

SOCIAL NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCN152 / 16SIT252/	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> The learning objective of the course Social Network Analysis is to discuss essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks. 			
Module 1			Teaching Hours
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.			8 Hours
Module 2			
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.			8 Hours
Module 3			
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.			8 Hours
Module 4			
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low - dimensional projections			8 Hours
Module 5			
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> Define notation and terminology used in network science. Demonstrate, summarize and compare networks. Explain basic principles behind network analysis algorithms. Analyzing real world network. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R)". Springer, 2014. 			

3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books:

1. NIL

MULTI-CORE ARCHITECTURE AND PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - I

Subject Code	16SCE24 / 16SCN153	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

Module -1

Teaching Hours

Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

8 Hours

Module -2

Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features

8 Hours

Module – 3

Threading APIs :Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

8 Hours

Module-4

OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance

8 Hours

Module-5

Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache

8 Hours

<p>Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.</p>	
<p>Course outcomes:</p>	
<p>The students shall be able to:</p> <ul style="list-style-type: none"> • Identify the limitations of ILP and the need for multicore architectures • Define fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Make out the salient features of different multicore architectures and how they exploit parallelism • Demonstrate the role of OpenMP and programming concept 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006 	
<p>Reference Books: NIL</p>	

SOFT COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SSE41 / 16SCS254 / 16SCN154	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain key aspects of soft computing. • Identify the components and building block hypothesis of Genetic algorithm. • Analyze Neuro Fuzzy modeling and control. • Evaluate machine learning through Support vector machines. 			
Module 1			Teaching Hours
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.			8 Hours
Module 2			
Perceptron Network: Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).			8 Hours
Module 3			
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.			8 Hours
Module 4			
Defuzzification: Fuzzy decision making, and applications.			8 Hours
Module 5			
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Implement machine learning through neural networks. • Design Genetic Algorithm to solve the optimization problem. • Develop a Fuzzy expert system. • Model Neuro Fuzzy system for clustering and classification. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, ISBN 13: 788126527410, 2011			
Reference Books:			
1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.			

COMPUTER NETWORKS AND INFORMATION SECURITY LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SCN16	IA Marks	20
Number of Lecture Hours/Week	01+03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonste Concepts of fundamental protocols.
- Illustrate internetworking concepts.
- Implement concepts in congestion control and error detections.
- Evaluate fundamentals of Cryptography through practical implementation.
- Implement standard algorithms used to provide confidentiality, integrity and authenticity.
- Design security applications in the field of Information technology.

PART – A Computer Network LABORATORY WORK

Note:

Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

Simulation Programs using OPNET /NS2/NS3 or any other equivalent software

8. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
9. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

PART – B INSLABORATORY WORK

2. Consider a file with composite data, substitute the content and transpose the ciphers.
3. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
4. Apply the RSA algorithm on a text file to produce cipher text file.
5. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
6. Implementation of Message Authentication Code using cryptography VMAC function.
7. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change

- in the input results in a substantial change in the output
- Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN (Sub-netting).

Course Outcomes

The students should be able to:

- Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Design and evaluate application layer protocol
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Conduction of Practical Examination:

- All laboratory experiments (nos) are to be included for practical examination.
- Students are allowed to pick one experiment from **each part and execute both**
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- PART –B:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

SEMINAR [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCE17 / 16SCN17 / 16LNI17 / 16SIT17 / 16SSE17 / 16SCS17 / 16SFC17	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-
CREDITS – 01			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
<p>The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:</p> <ol style="list-style-type: none"> 1. IEEE Transactions, journals, magazines, etc. 2. ACM Transactions, journals, magazines, SIG series, etc. 3. Springer 4. Elsevier publications etc <p>In the area of (to name few and not limited to)</p> <ul style="list-style-type: none"> • Web Technology • Cloud Computing • Artificial Intelligent • Networking • Security • Data mining 			
Course Outcomes			
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Conduct survey on recent technologies • Infer and interpret the information from the survey conducted • Motivated towards research 			
Conduction:			
<p>The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.</p>			
<p>Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).</p>			

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM
(CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16SCN21	Multimedia Communications	4	--	3	20	80	100	4
16SCN22	Cloud Computing	4	--	3	20	80	100	4
16SCN23	Network Management	4	--	3	20	80	100	4
16SCN24	Managing Big Data	4	--	3	20	80	100	4
16SCN25x	Course Electives – II	4	--	3	20	80	100	3
16SCN26	Mini-project	--	3 hrs lab	3	20	80	100	2
16SCN27	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Elective II

16SCN252 Wireless Sensor Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

III SEMESTER: Internship

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16SCN32	Report on Internship	-	-	-	25	-	25	
3	16SCN33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16SCN34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech (Computer Network Engineering)

IV SEMESTER

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16SCN41	Client Server Programming	4	-	3	20	80	100	4
2	16SCN42x	Course Electives-III	3	-	3	20	80	100	3
3	16SCN43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16SCN44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			7	-	6	90	360	450	20

Elective

16SCN421 Service Oriented Architecture

Note:

1. **Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/visit industries to finalize the topic of Project.
2. **Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
3. **Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
4. **Project evaluation:**
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks

MULTIMEDIA COMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN21/16LNI152	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the Multimedia Communication Models • Explain Multimedia Transport in Wireless Networks • Solve the Security issues in multimedia networks • Illustrate real-time multimedia network applications. • Explain different network layer based application. 			
Module 1			Teaching Hours
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,. Text, images, audio and video.			10 Hours
Module 2			
Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG			10 Hours
Module 3			
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.			10 Hours
Module 4			
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.			10 Hours
Module 5			
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Deploy the right multimedia communication models. • Apply QoS to multimedia network applications with efficient routing techniques. • Solve the security threats in the multimedia networks. • Develop the real-time multimedia network applications 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Fred Halsall, “Multimedia Communications”, Pearson education, 2001. 2. Raif Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson education, 2002. 			

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCS12/16SCE12 16SIT22/16SSE254 16SCN22/16LNI151	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define and Cloud, models and Services. • Compare and contrast programming for cloud and their applications • Explain virtualization, Task Scheduling algorithms. • Apply ZooKeeper, Map-Reduce concept to applications. 			
Module 1			Teaching Hours
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.			10 Hours
Module 2			
Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.			10 Hours
Module 3			
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems			10 Hours
Module 4			
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.			10 Hours
Module 5			
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine			10 Hours

<p>monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.</p>	
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Compare the strengths and limitations of cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Apply suitable virtualization concept. • Choose the appropriate cloud player • Address the core issues of cloud computing such as security, privacy and interoperability • Design Cloud Services • Set a private cloud 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.</p>	
<p>Reference Books: 1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. 2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.</p>	

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI154 / 16SCN23	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate need for interoperable network management. • Explain the concepts and architecture behind standards based network management. • Illustrate the concepts and terminology associated with SNMP and TMN • Demonstrate network management as a typical distributed application 			
Module 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards-Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions-Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			10 Hours
Module 2			10 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			10 Hours
Module 3			10 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			10 Hours
Module 4			10 Hours
Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL			10 Hours

Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	10 Hours
Course Outcomes	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books: 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.			10Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.			10 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS 			

- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN251	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain switching and multiplexing. • Analyze the transmission technology. And transmission control. • Demonstrate basic knowledge on telecommunication 			
Module -1			Teaching Hours
Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks			8 Hours
Module -2			
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization			8 Hours
Module – 3			
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing			8 Hours
Module-4			
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching			8 Hours
Module-5			
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems			8 Hours
Course outcomes:			
The student will be able to:			
<ul style="list-style-type: none"> • Explain basics of telecommunications and digital form • Elaborate switching and multiplexing, telecommunication. • Illustrate transmission control in telecommunication • Design and develop switching, multiplexing and traffic control. 			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • There will be 2 questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 			

Text Books:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Reference Books:

WIRELESS SENSOR NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN252	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain sensor networks for various application setups. • Demonstrate the design space and conduct trade-off analysis between performance and resources. • Assess coverage and conduct node deployment planning. • Devise appropriate data dissemination protocols and model links cost. • Determine suitable medium access protocols and radio hardware. • Illustrate sensor networks using commercial components. • Discuss quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints. 			
Module -1			Teaching Hours
Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. (Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)			8 Hours
Module -2			Teaching Hours
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies (Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)			8 Hours
Module – 3			Teaching Hours
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. (Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)			8 Hours
Module-4			Teaching Hours
Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware. (Chapter 7: 7.1-7.4, Chap. 8: 8.1-8.4)			8 Hours
Module-5			Teaching Hours
Network Management and Operating System for Wireless Sensor Networks: Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. (Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)			8 Hours
Course outcomes:			

The students shall able to:

- Explain existing applications of wireless sensor actuator networks
- Apply in the context of wireless sensor networks and explain elements of distributed computing and network protocol design
- Contrast Various hardware, software platforms that exist for sensor networks
- Summarize various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:", WILEY , Second Edition (Indian) , 2014

Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

OPTICAL NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define basic elements of optical fiber transmission link, fiber modes configurations and structures • Compare different kind of losses, signal distortion in optical wave guides and other signal degradation factors • List and explain various optical source materials, LED structures, quantum efficiency, and Laser diodes • Demonstrate fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration and also fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM 			
Module -1			Teaching Hours
Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.			8 Hours
Module -2			
WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.			8 Hours
Module – 3			
Control and Management: Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. Configuration Management: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol			8 Hours
Module-4			

<p>Basic Concepts: Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCh-Mesh Protection, GMPLS Protection, Interworking between Layers.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model, Maximum Load Dimensioning Models: Offline Light path Requests, Online RWA in Rings</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Explain fundamentals of optical network. • Analyze optical network architectures ranging from optical access networks to backbone optical transport networks. • Choose approaches and methodologies of optical network for design effective optimization; • Apply Techniques of optical network survivability. • Demonstrate problem solving skills and critical thinking in the discipline of optical networks. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <p>1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.</p>	
<p>Reference Books:</p> <p>1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.</p>	

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI23/ 16SCE23 16SCN254 / 16SIT23	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Analyze system requirements for mobile applications. • Apply of mobile development frameworks. • Demonstrate mobile application design. • Demonstrate and implement mobile application. 			
Module -1			Teaching Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.			8 Hours
Module -2			
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.			8 Hours
Module – 3			
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API.			8 Hours
Module-4			
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.			8 Hours
Module-5			
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications			8 Hours
Course outcomes:			
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Mobile Computing: (technologies and Applications-N. N. Jani S chand
2. B.M.Hirwani- Android programming Pearson publications-2013
3. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26 / 16SIT26 / 16SSE26	IA Marks	20
Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
<p>The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.</p>			
<p>Course outcomes:</p> <ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
<p>Conduction of Practical Examination:</p> <p>The student shall prepare the report by including:</p> <ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
<p>Evaluation:</p> <p>Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20</p>			

= 80 marks.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-

CREDITS – 01

Course objectives: This course will enable students to

- Motivate the students to read technical article
- Discover recent technology developments

Descriptions

The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

CLIENT SERVER PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SIT151 / 16LNI41 / 16SCN41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/o. • Define System Calls, Basic I/O Functions available in UNIX • Illustrate socket interface, TCP, UDP in detail. • Compare various client Software and various algorithms issue related to server software design. 			
Module 1			Teaching Hours
The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. Program Interface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.			10 Hours
Module 2			
The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.			10 Hours
Module 3			
Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.			10 Hours
Module 4			
Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs			10 Hours

<p>Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.</p>	
<p>Module 5</p>	
<p>Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/O. • Demonstrate programming System Calls, Basic I/O Functions available in UNIX • Implement Socket interface, TCP, UDP in detail. • Compare and contrast Client Software Various applications and their issues 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. NIL 	

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SSE13 /16SIT153 / 16SCN421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Interpret various architecture for application development • Demonstrate the importance of SOA in Application Integration • To learn web service and SOA related tools • To Learn implementation details of SOA • To understand various case studies 			
Module 1			Teaching Hours
SOA BASICS :Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models.			8 Hours
Module 2			
SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings.			8 Hours
Module 3			
SOA GOVERNANCE: SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software as a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices.			8 Hours
Module 4			
SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB Data binding.			8 Hours
Module 5			
APPLICATION INTEGRATION: JAX –WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Compare different IT architecture • Analyze and design of SOA based applications • Implement web service and realize of SOA • Implement REST full services • Design and implement of SOA based Application Integration using BPEL 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley 2008.

Reference Books:

1. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.
2. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

ANALYSIS OF COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain with the concepts of computer networks • What is a computer network and what are the fundamental protocols. • Analyze network architectures in stochastic and deterministic way. • Illustrate RSVP, Principles of TCP • Discover more on different network protocols. • Explain multiplexing, streaming sessions in computer network. 			
Module -1			Teaching Hours
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.			8 Hours
Module -2			
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.			8 Hours
Module – 3			
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).			8 Hours
Module-4			
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic			8 Hours
Module-5			
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive			8 Hours

Window Protocol; Bandwidth sharing in a Network.	
Course outcomes:	
On completion, student will be able to:	
<ul style="list-style-type: none"> List and classify network services, protocols and architectures, explain why they are layered. Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.	
Reference Books:	
1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.	
2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999	

NETWORK ROUTING ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> Discuss layered architecture for communication networks and the specific functionality of the network layer. Explain the basic principles of routing and the manner, this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network. Compare and contrast different routing algorithms existing and their performance characteristics. 			

Module -1	Teaching Hours
<p>NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits.</p> <p>Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra’s Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm</p> <p>Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost</p>	8 Hours
Module -2	
<p>ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution</p> <p>OSPF and Integrated IS-IS :From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF</p> <p>Internet Routing Architectures: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability</p>	8 Hours
Module – 3	
<p>Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. IP Address Lookup Algorithms: Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. IP Packet Filtering and Classification: Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.</p>	8 Hours
Module-4	
<p>ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, Ad hoc routing, Mesh routing, Vehicular routing, Sensor routing</p>	8 Hours
Module-5	

<p>TOWARD NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing</p> <p>MPLS and GMPLS: Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. Routing and Traffic Engineering with MPLS: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. VoIP Routing: Interoperability through IP and PSTN : PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<ul style="list-style-type: none"> • Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance. • The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Deepankar Medhi and Karthikeyan Ramasamy, “Network Routing: Algorithms, Protocols, and Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007 2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons, Inc, © ISTE Ltd 2014 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002. 2. M. Steen Strub, “Routing in Communication network,” Prentice –Hall International, Newyork, 1995. 3. James D. McCabe, “Network Analysis, Architecture, and Design”, 3rd Edition, 2007 Elsevier Inc. 	

WEB MINING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN424	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Compare and contrast different knowledge discovery issues in Web mining. • Analyze the different algorithms commonly used by Web application. • Apply the role played by Web mining in Information retrieval and extraction • Demonstrate the documents structures and grouping, • Use the probabilistic model for web mining • Illustrate applications using Web mining 			
Module -1			Teaching Hours
<p>INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining . INFRASTRUCTURE and WEB SEARCH -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search.</p>			8 Hours
Module -2			
<p>INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction</p>			8 Hours
Module – 3			
<p>LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding’s – Probabilistic Approaches to clustering – Collaborative Filtering, SUPERVISED LEARNING: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection.</p>			8 Hours
Module-4			

<p>LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISED LEARNING-- Expectation Maximization, Labeling Hypertext Graphs and Co- training.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> • Identify the application areas for web content mining, web structure mining and webusage mining. • Design to retrieval the web data • Develop schemes to crawl the web data, organize and index • Cluster the documents for fast access • Develop algorithms used by web mining applications. • Select between different approaches and techniques of web mining 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sholom Weiss, “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005 2. Soumen Chakrabarti, “Mining the Web: Discovery Knowledge from Hypertext Data,” Elsevier Science 2003 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Min Song, Yi-fang Brok Wu, “Handbook of Research on Text and Web Mining Technologies”, Vol I & II, Information Science Reference (IGI), 2009 2. K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining Theory and Practice ,” Prentice Hall of India Private Ltd 2006 3. Anthony Scime, “Web Mining Applications and Techniques”, Idea Group Publishing,2005 4. Margret H.Dunham “DATA MINING - Introductory and Advanced Concepts”, PearsonEducation,2003. 	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / FieldWork / Assignment / Tutorials		I.A.	Exam		
14SCN11	Wireless Adhoc Networks	4	2 *	03	50	100	150	4
14SCN12	Advanced in Computer Networks	4	2 *	03	50	100	150	4
14SCN13	Information and Network Security	4	--	03	50	100	150	4
14SCN14	Advanced in Storage Area Network	4	2	03	50	100	150	4
14SCN15x	Elective – I	4	2	03	50	100	150	4
14SCN16	Information and Network Security Laboratory	0	3	03	25	50	75	2
14SCN17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I

14SCN152 Computer Systems Performance Analysis

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH (COMPUTER NETWORK ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14SCN21	Multimedia Communications	4	2 *	03	50	100	150	4
14SCN22	Distributed Computing	4	--	03	50	100	150	4
14SCN23	Network Management	4	2 *	03	50	100	150	4
14SCN24	Switching & Statistical Multiplexing In Telecommunications	4	2	03	50	100	150	4
14SCN25 _x	Elective – II	4	2	03	50	100	150	4
14SSCN26	Distributed Computing Laboratory	0	3	03	25	50	75	2
14SCN27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCN252 Wireless Sensor Networks

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	--	--	-	25	--	25	1
14SCN32	Report on Internship	--	--	-	--	75	75	15
14SCN33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	--	--	3	25	125	150	20

ELECTIVE- III

14SCN422

Service Oriented Architecture

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS	
		Lecture	Fieldwork / Assignment / Tutorials		I.A.	Exam			
14SCN41	Client Server Programming *	4	2 *	03	50	100	150	4	
14SCN42x	Elective-III	4	2	03	50	100	150	4	
14SCN43	Evaluation of Project Phase-II	0	--	--	25	--	25	1	
14SCN44	Evaluation of Project Phase-III	0	--	--	25	--	25	1	
14SCN45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	150	18	
Total		08	07	09	150	400	550	28	
Grand Total (I to IV Sem.)		Marks: 2400; Credits : 94							

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or technical paper.

1).Project Phase – I : 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase – III : Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be $50+50+100=200$ (50 Marks for Internal Guide, 50 Marks for External and 100 for Viva-Voce)

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Course Title: Wireless Ad-hoc Networks	Course Code: 14SCN11
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To explore the design space and conduct trade-off analysis between performance and resources.
- To Determine suitable medium access protocols and radio hardware.
- To learn Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- To explore the Ad-hoc network concepts by using network simulators.

TOPICS

MODULE I

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet;
MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas
 (Chapter 5: 5.1-5.3, Chapter 6: 6.1-6.8) **10 Hours**

MODULE II

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols
 (Chapter 7: 7.1-7.6, 7.8, 7.9) **10 Hours**

MODULE III

Multicast Routing in Ad hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
 (Chapter 8: 8.1-8.7) **10 Hours**

MODULE IV

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad hoc Wireless Networks.
 (Chapter 9: 9.1-9.6, 9.7-9.12) **10 Hours**

MODULE V

Quality of Service and Energy Management in Ad hoc Wireless Networks

Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

(Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6)

10 Hours

LABORATORY WORK

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.
- 2: Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.
4. Develop and Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.
5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

COURSE OUTCOMES

Students will be able to

- Apply knowledge of wireless Ad-hoc networks to various application areas.
- Design, implement and maintain wireless Ad-hoc networks.
- Formulate and solve problems creatively.
- Practical knowledge acquired by hands-on session.

TEXT BOOKS:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

Semester I

Year: 2014-2015

Course Title: Advances in Computer Networks	Course Code: 14SCN12
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To become familiar with the basics of Computer Networks.
- To learn Network architectures.
- To learn Concepts of fundamental protocols.
- To gain the knowledge of internetworking concepts.
- To understand the knowledge of internetworking concepts in various applications.
- To acquire knowledge of implementation concepts in congestion control and error detections.

TOPICS

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1:Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2:Chapter 4

10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2.

10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

T1: Chapter 3.3, 4.1.1, 4.1.3 **T2:** Chapter 13.1 to 13.18, Chapter 18.

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3

10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP).

T1: Chapter 6.4 **T2:** Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8

10 Hours

LABORATORY WORK

PART A: Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

COURSE OUTCOMES

Students will be able to

- Classify network services, protocols and architectures, explain why they are layered.
- Knowledge on key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Practical knowledge gained by hands-on sessions.
- Gain the knowledge of application layer protocol.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier - 2014
2. **T2: Douglas E Comer,** “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Inte rfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill.

Semester I

Year: 2014-2015

Course Title: Information and Network Security	Course Code: 14SCN13
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

TOPICS

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, ..

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer** :SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication

plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

References

1. V k Pachghare: Cryptography and Information Security. PHI Learning. ISBN 978-81-203-3521-9

Semester I

Year: 2014-2015

Course Title: Advances in Storage area Network	Course Code: 14SCN14
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre’s maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems
- To appreciate the use of cables technologies used in SAN technology.

TOPICS

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **10 Hours**

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **10 Hours**

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network;

Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Have Knowledge on various RAID levels.
- Apply the techniques used for data maintenance.
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Semester I

Year: 2014-2015

Course Title: Advanced algorithms	Course Code: 14SCN151
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To get an awareness of probabilistic and randomize algorithms.

TOPICS

MODULE I

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

COURSE OUTCOMES:

The students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Get knowledge about different application based algorithm.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Course Title: Computer Systems Performance Analysis	Course Code: 14SCN152
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To understand the concept of planning and design in computer system.

TOPICS

TOPICS:

MODULE I

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

10 Hours

MODULE II

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

10 Hours

MODULE III

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

10 Hours

MODULE IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. **Experimental Design and Analysis: Introduction:** Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

10 Hours

MODULE V

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow

Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Define Little's law and other operational laws
- Apply the operational laws to open and closed systems
- Use discrete-time and continuous-time Markov chains to model real world systems
- Develop analytical techniques for evaluating scheduling policies

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Semester I

Year: 2014-2015

Course Title: Multi-core Architecture and Programming	Course Code: 14SCN153
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multi core architectures
- To expose the students to warehouse-scale and embedded architectures

TOPICS

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

10 Hours

MODULE II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours

MODULE III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours

MODULE IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006.

Semester I

Year: 2014-2015

Course Title: Soft Computing	Course Code: 14SCN154
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

Topics:

MODULE I

Introduction to Soft computing, Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model. **10 Hours**

MODULE II

Perceptron Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propogation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models) **10 Hours**

MODULE III

Introduction to classical sets and fuzzy sets, Classical relations and fuzzy relations, Membership functions, **10 Hours**

MODULE IV

Defuzzification, Fuzzy decision making, and applications **10 Hours**

MODULE V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA
General genetic algorithms, The schema theorem, Genetic programming, applications

10 Hours

Course Outcomes:

The student will be able to:

- Implement machine learning through neural networks.

- Write Genetic Algorithm to solve the optimization problem
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.

Text book:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, Jun-2007
(Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

Reference Books:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, PHI (EEE edition) ISBN: 978-81-203-2243-1

Semester I

Year: 2014-2015

Course Title: Information and Network security Lab	Course Code: 14SCN16
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives:

- To understand the fundamentals of Cryptography through practical implementation.
- To implement standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to use cutting edge simulation tools
- To design security applications in the field of Information technology.

LABORATORY WORK

Note: Use C/C++/Java or equivalent tool to implement the following experiment

1. Consider a file with composite data, substitute the content and transpose the ciphers.
2. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
3. Apply the RSA algorithm on a text file to produce cipher text file.
4. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
5. Implementation of Message Authentication Code using cryptography VMAC function.
6. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output
7. Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN [Subnetting].
8. Develop a mechanism to setup(configure) a port scanner and identify the intrusion.

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Semester II

Year: 2014-2015

Course Title: Multimedia Communications	Course Code: 14SCN21
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

Course Objectives:

- To understand the Multimedia Communication Models
- To study the Multimedia Transport in Wireless Networks
- To solve the Security issues in multimedia networks
- To explore real-time multimedia network applications.
- To explore different network layer based application.

TOPICS

MODULE I

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework. **10 Hours**

MODULE II

Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards. **10 Hours**

MODULE III

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access. **10 Hours**

MODULE IV

Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution. **10 Hours**

MODULE V

Network Layer: Introduction, QoS in Network Multimedia Systems. **10 Hours**

LABORATORY WORK

The following experiments should be practiced (Tools such as HTML/Frontpage/Dreamweaver/ equivalent, Multimedia application enabling software ,System software support for multimedia, Performance measurement tools for multimedia ,Multimedia authoring tools, Web tools and applications)

1. Audio and video editing
2. Image editing
3. 2D and 3D animation.

.The case studies are:

- Video on-demand
- Interactive TV
- Home shopping
- Remote home care
- Electronic album
- Personalized electronic journals.

COURSE OUTCOMES:

Students will be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network applications.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

Semester II

Year:2014-2015

Course Title: Distributed Computing	Course Code: 14SCN22
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To learn Basic Concepts of DSM, Hardware DSM
- To understand File Sharing, DFS Implementation, Replication in DFS,
- To understand the concepts of Cryptanalysis, Secure channels, Access control.
- To understand some of the security concepts in distributed computing.

TOPICS

MODULE I

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

10 hours

MODULE II

Distributed Shared Memory :Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

10 hours

MODULE III

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies. **Naming**: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

10 hours

MODULE IV

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies.

10 hours

MODULE V

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS. **Emerging Trends in distributed Computing**: Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

10 hours

COURSE OUTCOMES:

The student will be able to

- Realize shared memory concept.
- Realize Advantages of DFS.
- Implement mechanisms to manage security in DS

Text Book.

1. Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010

Semester II

Year:2014-2015

Course Title: Network Management	Course Code: 14SCN23
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the need for interoperable network management.
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP and TMN.
- To understand network management as a typical distributed application

TOPICS

MODULE I

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. **10 Hours**

MODULE II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. **10 Hours**

MODULE III

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model
SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. **10 Hours**

MODULE IV

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles. **10 Hours**

MODULE V

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation

Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **10 Hours**

LABORATORY WORK:

1. Capture packets transferred while browsing a selected website (e.g. a page from the course website, a search engine home page). Investigate the protocols used in each packet, the values of the header fields and the packet sizes.
2. Explore at least the following features of Wireshark: filters, Flow Graphs (TCP), statistics, protocol hierarchies.
3. Create several example files for your Apache web server to serve. Configure your web server, and then ask a friend to test your web server by accessing the files. Capture the packets and observe the log file.
4. Configure authentication for a specific directory on your web server. Test, captured packets and observe the log file.
5. Login to another computer in the lab, capture and investigate the data exchanged.
6. Trace the path between several pairs of source/destination nodes.
7. Create fire wall rule(s) that will drop TCP packets destined to a specific computer on the lab network (e.g. yours neighbors computer).
8. Using the supplied client/server sockets programs, implement a third proxy server.

Note: NS2 or equivalent tool to be used.

Course Outcomes:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Semester II

Year:2014-2015

Course Title: Switching & Statistical Multiplexing in Telecommunications	Course Code: 14SCN24
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand Switching and multiplexing.
- To understand the transmission technology.
- To understand the transmission control.
- To understand basic knowledge on telecommunication.

Topics:

MODULE I

Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. **Why Digital:** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

10 Hours

MODULE II

Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

10 Hours

MODULE III

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. **Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

10 Hours

MODULE IV

Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

10 Hours

MODULE V

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

10 Hours

Course Outcomes:

The student will be able to:

- Gain the knowledge about switching and multiplexing
- Gain the knowledge about telecommunication.
- Learn transmission control in telecommunication.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Semester II

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCN251
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To gain knowledge Virtualization
- To gain knowledge Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- To gain knowledge in cloud resource virtualization and scheduling.

TOPICS:

MODULE I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

MODULE II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

MODULE III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study:Xen a VMM based

paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

MODULE IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

MODULE V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

Course Outcomes:

The student will be able to:

- Demonstrate simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Semester II

Year:2014-2015

Course Title: Wireless Sensor Networks	Course Code: 14SCN252
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.

- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

TOPICS:

MODULE I

Introduction, Overview and Applications of Wireless Sensor Networks

Introduction, Basic overview of the Technology, **Applications of Wireless Sensor Networks:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology

(Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)

10 Hours

MODULE II

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, **Wireless Transmission Technology and Systems:** Introduction, Radio Technology Primer, Available Wireless Technologies

(Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)

10 Hours

MODULE III

MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **Routing Protocols for Wireless Sensor Networks:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

(Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)

10 Hours

MODULE IV

Transport Control and Middleware for Wireless Sensor Networks

Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. **Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

(Chapter 7: 7.1-7.4, Chapter 8: 8.1-8.4)

10 Hours

MODULE V

Network Management and Operating System for Wireless Sensor Networks

Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. **Operating Systems for Wireless Sensor Networks:** Introduction, Operating System Design Issues, Examples of Operating Systems.

(Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)

10 Hours

COURSE OUTCOMES

The student will be able to:

- Develop applications of wireless sensor actuator networks
- Implement the elements of distributed computing and network protocol .

- Explore various hardware, software platforms that exist for sensor networks

TEXT BOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications”, WILEY , Second Edition (Indian) , 2014

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.

Semester II

Year: 2014-2015

Course Title: Optical Networks	Course Code: 14SCN253
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM
- To acquire knowledge about fault and congestion management.

Topics

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, SONET/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel. **10 Hours**

MODULE II

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations. **10 Hours**

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum Load **Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Design a system, component or process as per needs and specification.
- Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
- Gain the knowledge on methodologies of optical network design optimization;
- Explore techniques of optical network survivability.
- Solve the Problems in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advances in VLSI Design and Algorithms	Course Code: 14SCN254
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- Able to understand the fundamentals of CMOS VLSI and associated technologies.
- Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
- Able to appreciate the design process in VLSI, GALS.
- Able to explain basic operation principles of diodes and MOS FPGAs; PLA.
- Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout

TOPICS:**MODULE I**

Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing; Integrated Circuit Design Techniques; IP-Based Design.

Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

10 Hours**MODULE II**

Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

10 Hours**MODULE III**

Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

10 Hours**MODULE IV**

Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

10 Hours**MODULE V**

Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

10 Hours

Course Outcomes:

The student will be able to:

- Clear understanding of important concepts in CMOS technology and fabrication that affect design.
- Apply two-level and multi-level logic minimization techniques to the given Boolean logic function.
- Design and develop Layout a gate in CMOS VLSI technology.

TEXT BOOKS:

1. Wayne Wolf: “Modern VLSI design”, 4th Edition, P HI Learning, 2007.
2. Sabih H Gerez: “Algorithms for VLSI Design Autom ation”, Wiley India, 2007.

Semester II

Year: 2014-2015

Course Title: Distributed Computing Lab	Course Code: 14SCN26
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives

- To understand the main ideas and concepts on web services.
- Studying and working on a related topic of internet applications such as information hiding, system security and E-learning.
- To understand the concepts of UDDI, SOAP, JMS remote procedure calls.

LIST OF EXPERIMENTS:

Note: Use appropriate tools/language to implement the following experiment:

1. Design and implement client server application using RMI (Remote Method Invocation) to invoke a service to calculate the income tax.
2. Design and implement EJB (Entity Java Beans) session bean business logic to calculate income tax and invoke the service using stub, i.e., client side proxy object.
3. Design and implement an EJB entity bean to persist the client submitted data into an enterprise information system.
4. Design and implement an offline database communication system using JMS (Java Message Service) to service the client request.
5. Design and implement the client code to call the Micro soft service like free service from UDDI (Universal Description Discovery Protocol).
6. Design and implement business logic and bind it as service using SOAP (Simple Object Access Protocol), also implement client to call service.

NOTE: Use EJB 3.X or any equivalent tool.

COURSE OUTCOMES:

The student will be able to

- Develop and debug RPC based client-Server programs in UNIX.
- Realize the partial implementation of UDDI, SOAP, JMS in Web applications.

Semester IV

Year: 2014-2015

Course Title: Client-Server Programming	Course Code: 14SCN41
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand **Client-Server software**, Context Switching and Protocol Software, I/o.
- To understand System Calls, Basic I/O Functions available in UNIX
- To understand the Socket interface, TCP, UDP in detail.
- Various client software applications and their issues.
- To understand the concept of Socket interface in client server programming.

TOPICS:

MODULE I

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts
Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP. **10 Hours**

MODULE II

The Socket Interface: Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **10 Hours**

MODULE III

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays,

A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

MODULE IV

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

MODULE V

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

LABORATORY WORK:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Design, develop, and execute a program using JAVA networking facilities to implement a simple Day / Time Server and demonstrate its functioning. Repeat the above problems.

COURSE OUTCOMES

The student will be able to:

- Gain in depth knowledge about Client-Server software, Context Switching and Protocol Software, I/o.
- Programming System Calls, Basic I/O Functions available in UNIX
- Gain the knowledge on Socket interface, TCP, UDP in details.
- Pros and cons of Client Software Various applications and their issues.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Title: Analysis of Computer Networks	Course Code: 14SCN421
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To Become familiar with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- To analyze network architectures in stochastic and deterministic way.
- RSVP, Principles of TCP
- To explore more on different network protocols.
- To understand the knowledge of multiplexing, streaming sessions in computer network.

TOPICS:**MODULE I**

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

10 Hours**MODULE II**

Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

10 Hours**MODULE III**

Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

10 Hours**MODULE IV**

Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

10 Hours**MODULE V**

Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

10 Hours**Course Outcomes:**

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

Semester IV

Year:2014-2015

Course Title: Service Oriented Architecture	Course Code: 14SCN422
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand various architecture for application development
- To understand the importance of SOA in Application Integration
- To learn web service and SOA related tools.
- To learn the concepts of SOA governance.

Topics:

MODULE I

SOA BASICS: Software Architecture – Types of IT Architecture – S OA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architec ture – Enterprise Applications – Solution Architect ure for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models

10 Hours

MODULE II

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Ac tivity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits o f SPA – Cost Savings

10 Hours

MODULE III

SOA GOVERNANCE :SOA implementation and Governance – strategy – SOA d evelopment – SOA governance – trends in SOA – event-driven architect ure – software s a service – SOA technologies – pro of-of-concept – process orchestration – SOA best practice s

10 Hours

MODULE IV

SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL, SOAP and Java/XML mapping in SOA – JAXB Data binding.

10 Hours

MODULE V

APPLICATION INTEGRATION: JAX-WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study – WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Compare the different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Text Book:

1. Shankar Kambhampaly, “Service-Oriented Architecture for Enterprise Applications”, Wiley 2008.

REFERENCES:

2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.
3. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009.

Semester IV

Year: 2014-2015

Course Title: Mobile Application Development	Course Code: 14SCN423
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To Understand system requirements for mobile applications
- To Generate suitable design using specific mobile development frameworks
- To Generate mobile application design
- To Implement the design using specific mobile development frameworks
- To acquire knowledge of android applications development.

Topics:

MODULE I

Introduction to mobile communication and computing:, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover

and security. Smart phone operating systems and smart phones applications.

10 Hours

MODULE II

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control .

10 Hours

MODULE III

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

10 Hours

MODULE IV

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations,

10 Hours

MODULE V

Displaying web pages and maps, communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications.

10 Hours

Course Outcomes:

The student will be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop and design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS

Text Books:

1. Mobile Computing: Technologies and Applications- N. N. Jani S chand,2009.
2. B.M.Hirwani- Android programming Pearson publications-2013

Course Title: Cybercrime and Digital Forensic	Course Code: 14SCN424
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To understand Accounting Forensics
- To analyze the nature and effect of cyber crime in society.
- To understand Sarbanes-Oxley Financial and Accounting Disclosure Information
- To understand Computer Crime and Criminals
- To understand Liturgical Procedures

Topics:**MODULE I**

INTRODUCTION: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

10 Hours**MODULE II**

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

10 Hours**MODULE III**

INVESTIGATION: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

10 Hours**MODULE IV**

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics. **10 Hours**

MODULE V

LAWS AND ACTS: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

10 Hours

Course Outcomes

The student will be able to:

- Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.
- Distinguish various types of computer crime, and use computer forensic techniques to identify the digital fingerprints associated with criminal activities.
- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- Develop a custom computer forensic analysis tool.

Text:

1. Nelson Phillips and Einfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw -Hill , New Delhi, 2006.

References:

3. Robert M Slade, “Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE
BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND
EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCN11	Wireless Ad-hoc Networks	4	-	3	20	80	100	4
16SCN12	Advances in Computer Networks	4	--	3	20	80	100	4
16SCN13	Information and Network Security	4	--	3	20	80	100	4
16SCN14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCN15X	Course Electives - 1	4	--	3	20	80	100	3
16SCN16	Computer Networks and Information Security Laboratory	--	3 (2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCN17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives I	
16SCN153	Multi Core Architecture and Programming

WIRELESS AD-HOC NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI251 / 16SCE421 / 16SCN11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamental principles of Ad-hoc Networks • Discuss a comprehensive understanding of Ad-hoc network protocols • Outline current and emerging trends in Ad-hoc Wireless Networks. • Analyze energy management in ad-hoc wireless networks. 			
Module -1			Teaching Hours
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.			10Hours
Module -2			10 Hours
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.			
Module – 3			10 Hours
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.			
Module-4			10 Hours
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks.			
Module-5			10 Hours
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.			
Course outcomes:			
The students shall able to:			
<ul style="list-style-type: none"> • Design their own wireless network • Evaluate the existing network and improve its quality of service • Choose appropriate protocol for various applications • Examine security measures present at different level 			

- Analyze energy consumption and management

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – I

Subject Code	16SCN12/16SCS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss with the basics of Computer Networks.
- Compare various Network architectures.
- Discuss fundamental protocols.
- Define and analyze network traffic, congestion, controlling and resource allocation.

Module 1	Teaching Hours
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<p>Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4</p>	10 Hours
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Module 2	Teaching Hours
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<p>Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2,</p>	10 Hours
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Module 3	Teaching Hours
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<p>Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18.</p>	10 Hours
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Module 4	Teaching Hours
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<p>End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3</p>	10 Hours
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Module 5	Teaching Hours
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<p>Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8</p>	10 Hours
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Course Outcomes

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014.

Reference Books:

1. Uyles Black, “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI.
2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill.

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI12/16SCN13/16SCS253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Teaching Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm			10 Hours
Module 2			
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.			10 Hours
Module 3			
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.			10 Hours
Module 4			
Wireless network security: Wireless security, Wireless network threats, Wireless			10 Hours

<p>network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol</p>	
<p>Module 5</p>	
<p>Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. William Stallings, Cryptography and Network Security, Pearson 6th edition.</p>	
<p>Reference Books: 1. V K Pachghare: Cryptography and Information Security.</p>	

PROBABILITY STATISTICS AND QUEUING THEORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16LNI14 / 16SCN14/16SCS14/ 16SSE14 / 16SIT14 /16SCE14 / 16SFC14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing.
- Apply above concepts in Engineering and Technology.
- Acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Module 1	Teaching Hours
Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	10 Hours

Module 2	Teaching Hours
Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	10 Hours

Module 3	Teaching Hours
Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	10 Hours

Module 4	Teaching Hours
Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, χ^2 – test for goodness of fit, χ^2 test for Independence	10 Hours

Module 5	Teaching Hours
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	10 Hours

Course Outcomes

The students should be able to:

- Demonstrate use of probability and characterize probability models using probability mass (density) functions & cumulative distribution functions.
- Explain the techniques of developing discrete & continuous probability distributions and its applications.
- Describe a random process in terms of its mean and correlation functions.
- Outline methods of Hypothesis testing for goodness of fit.
- Define the terminology & nomenclature appropriate queuing theory and also distinguish various queuing models.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India ,2004.
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16LNI253 /16SCE253 /16SCN151 /16SCS24 /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			8 Hours
Module -2			8 Hours
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP), IPSO			8 Hours
Module – 3			8 Hours
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.			8 Hours
Module-4			8 Hours
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.			8 Hours
Module-5			8 Hours
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.			8 Hours
Course outcomes:			
At the end of this course the students will be able to: <ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business 			

- Understand the practical knowledge through different case studies
- Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

SOCIAL NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCN152 / 16SIT252/	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> The learning objective of the course Social Network Analysis is to discuss essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks. 			
Module 1			Teaching Hours
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.			8 Hours
Module 2			
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.			8 Hours
Module 3			
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.			8 Hours
Module 4			
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low - dimensional projections			8 Hours
Module 5			
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> Define notation and terminology used in network science. Demonstrate, summarize and compare networks. Explain basic principles behind network analysis algorithms. Analyzing real world network. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, 2014. 			

3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books:

1. NIL

MULTI-CORE ARCHITECTURE AND PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER - I

Subject Code	16SCE24 / 16SCN153	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

Module -1	Teaching Hours
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Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.	8 Hours
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Module -2	Teaching Hours
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Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features	8 Hours
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Module - 3	Teaching Hours
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Threading APIs :Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.	8 Hours
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Module-4	Teaching Hours
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OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance	8 Hours
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Module-5	Teaching Hours
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Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache	8 Hours
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Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.	
Course outcomes:	
The students shall be able to: <ul style="list-style-type: none"> • Identify the limitations of ILP and the need for multicore architectures • Define fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Make out the salient features of different multicore architectures and how they exploit parallelism • Demonstrate the role of OpenMP and programming concept 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006	
Reference Books: NIL	

SOFT COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SSE41 / 16SCS254 / 16SCN154	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain key aspects of soft computing. • Identify the components and building block hypothesis of Genetic algorithm. • Analyze Neuro Fuzzy modeling and control. • Evaluate machine learning through Support vector machines. 			
Module 1			Teaching Hours
Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.			8 Hours
Module 2			
Perceptron Network: Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).			8 Hours
Module 3			
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.			8 Hours
Module 4			
Defuzzification: Fuzzy decision making, and applications.			8 Hours
Module 5			
Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Implement machine learning through neural networks. • Design Genetic Algorithm to solve the optimization problem. • Develop a Fuzzy expert system. • Model Neuro Fuzzy system for clustering and classification. 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
1. Principles of Soft computing, Shivanandam, Deepa S. N, Wiley India, ISBN 13: 788126527410, 2011			
Reference Books:			
1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.			

COMPUTER NETWORKS AND INFORMATION SECURITY LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SCN16	IA Marks	20
Number of Lecture Hours/Week	01+03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonste Concepts of fundamental protocols.
- Illustrate internetworking concepts.
- Implement concepts in congestion control and error detections.
- Evaluate fundamentals of Cryptography through practical implementation.
- Implement standard algorithms used to provide confidentiality, integrity and authenticity.
- Design security applications in the field of Information technology.

PART – A Computer Network LABORATORY WORK

Note:

Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

Simulation Programs using OPNET /NS2/NS3 or any other equivalent software

8. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
9. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

PART – B INSLABORATORY WORK

2. Consider a file with composite data, substitute the content and transpose the ciphers.
3. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
4. Apply the RSA algorithm on a text file to produce cipher text file.
5. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
6. Implementation of Message Authentication Code using cryptography VMAC function.
7. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change

- in the input results in a substantial change in the output
- Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN (Sub-netting).

Course Outcomes

The students should be able to:

- Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Design and evaluate application layer protocol
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Conduction of Practical Examination:

- All laboratory experiments (nos) are to be included for practical examination.
- Students are allowed to pick one experiment from **each part and execute both**
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- PART –B:** Procedure + Conduction + Viva: **10 + 20 +10 (40)**
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

SEMINAR [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – I			
Subject Code	16SCE17 / 16SCN17 / 16LNI17 / 16SIT17 / 16SSE17 / 16SCS17 / 16SFC17	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-
CREDITS – 01			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
<p>The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:</p> <ol style="list-style-type: none"> 1. IEEE Transactions, journals, magazines, etc. 2. ACM Transactions, journals, magazines, SIG series, etc. 3. Springer 4. Elsevier publications etc <p>In the area of (to name few and not limited to)</p> <ul style="list-style-type: none"> • Web Technology • Cloud Computing • Artificial Intelligent • Networking • Security • Data mining 			
Course Outcomes			
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Conduct survey on recent technologies • Infer and interpret the information from the survey conducted • Motivated towards research 			
Conduction:			
<p>The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.</p>			
<p>Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).</p>			

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM
(CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech (Computer Network Engineering)

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16SCN21	Multimedia Communications	4	--	3	20	80	100	4
16SCN22	Cloud Computing	4	--	3	20	80	100	4
16SCN23	Network Management	4	--	3	20	80	100	4
16SCN24	Managing Big Data	4	--	3	20	80	100	4
16SCN25x	Course Electives – II	4	--	3	20	80	100	3
16SCN26	Mini-project	--	3 hrs lab	3	20	80	100	2
16SCN27	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Elective II

16SCN252 Wireless Sensor Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

III SEMESTER: Internship

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16SCN32	Report on Internship	-	-	-	25	-	25	
3	16SCN33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16SCN34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech (Computer Network Engineering)

IV SEMESTER

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16SCN41	Client Server Programming	4	-	3	20	80	100	4
2	16SCN42x	Course Electives-III	3	-	3	20	80	100	3
3	16SCN43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16SCN44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			7	-	6	90	360	450	20

Elective

16SCN421 Service Oriented Architecture

Note:

- 1. Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.
- 2. Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
- 3. Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
- 4. Project evaluation:**
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks

MULTIMEDIA COMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN21/16LNI152	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the Multimedia Communication Models • Explain Multimedia Transport in Wireless Networks • Solve the Security issues in multimedia networks • Illustrate real-time multimedia network applications. • Explain different network layer based application. 			
Module 1			Teaching Hours
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,. Text, images, audio and video.			10 Hours
Module 2			
Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG			10 Hours
Module 3			
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.			10 Hours
Module 4			
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.			10 Hours
Module 5			
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Deploy the right multimedia communication models. • Apply QoS to multimedia network applications with efficient routing techniques. • Solve the security threats in the multimedia networks. • Develop the real-time multimedia network applications 			
Question paper pattern:			
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.			
Text Books:			
<ol style="list-style-type: none"> 1. Fred Halsall, “Multimedia Communications”, Pearson education, 2001. 2. Raif Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson education, 2002. 			

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCS12/16SCE12 16SIT22/16SSE254 16SCN22/16LNI151	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define and Cloud, models and Services. • Compare and contrast programming for cloud and their applications • Explain virtualization, Task Scheduling algorithms. • Apply ZooKeeper, Map-Reduce concept to applications. 			
Module 1			Teaching Hours
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.			10 Hours
Module 2			
Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.			10 Hours
Module 3			
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems			10 Hours
Module 4			
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.			10 Hours
Module 5			
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine			10 Hours

<p>monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.</p>	
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Compare the strengths and limitations of cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Apply suitable virtualization concept. • Choose the appropriate cloud player • Address the core issues of cloud computing such as security, privacy and interoperability • Design Cloud Services • Set a private cloud 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.</p>	
<p>Reference Books: 1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. 2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.</p>	

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI154 / 16SCN23	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate need for interoperable network management. • Explain the concepts and architecture behind standards based network management. • Illustrate the concepts and terminology associated with SNMP and TMN • Demonstrate network management as a typical distributed application 			
Module 1			Teaching Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards-Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions-Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.			10 Hours
Module 2			10 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.			10 Hours
Module 3			10 Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.			10 Hours
Module 4			10 Hours
Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL			10 Hours

Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	10 Hours
Course Outcomes	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books: 1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.</p>	
<p>Reference Books: 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.</p>	

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.			10Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.			10 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS 			

- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN251	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain switching and multiplexing. • Analyze the transmission technology. And transmission control. • Demonstrate basic knowledge on telecommunication 			
Module -1			Teaching Hours
Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks			8 Hours
Module -2			
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization			8 Hours
Module – 3			
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing			8 Hours
Module-4			
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching			8 Hours
Module-5			
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems			8 Hours
Course outcomes:			
The student will be able to:			
<ul style="list-style-type: none"> • Explain basics of telecommunications and digital form • Elaborate switching and multiplexing, telecommunication. • Illustrate transmission control in telecommunication • Design and develop switching, multiplexing and traffic control. 			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • There will be 2 questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module. 			

Text Books:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Reference Books:

WIRELESS SENSOR NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN252	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain sensor networks for various application setups. • Demonstrate the design space and conduct trade-off analysis between performance and resources. • Assess coverage and conduct node deployment planning. • Devise appropriate data dissemination protocols and model links cost. • Determine suitable medium access protocols and radio hardware. • Illustrate sensor networks using commercial components. • Discuss quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints. 			
Module -1			Teaching Hours
Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. (Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)			8 Hours
Module -2			Teaching Hours
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies (Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)			8 Hours
Module – 3			Teaching Hours
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. (Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)			8 Hours
Module-4			Teaching Hours
Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware. (Chapter 7: 7.1-7.4, Chap. 8: 8.1-8.4)			8 Hours
Module-5			Teaching Hours
Network Management and Operating System for Wireless Sensor Networks: Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. (Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)			8 Hours
Course outcomes:			

The students shall able to:

- Explain existing applications of wireless sensor actuator networks
- Apply in the context of wireless sensor networks and explain elements of distributed computing and network protocol design
- Contrast Various hardware, software platforms that exist for sensor networks
- Summarize various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:", WILEY , Second Edition (Indian) , 2014

Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

OPTICAL NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define basic elements of optical fiber transmission link, fiber modes configurations and structures • Compare different kind of losses, signal distortion in optical wave guides and other signal degradation factors • List and explain various optical source materials, LED structures, quantum efficiency, and Laser diodes • Demonstrate fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration and also fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM 			
Module -1			Teaching Hours
Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.			8 Hours
Module -2			
WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.			8 Hours
Module – 3			
Control and Management: Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. Configuration Management: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol			8 Hours
Module-4			

<p>Basic Concepts: Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model, Maximum Load Dimensioning Models: Offline Light path Requests, Online RWA in Rings</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Explain fundamentals of optical network. • Analyze optical network architectures ranging from optical access networks to backbone optical transport networks. • Choose approaches and methodologies of optical network for design effective optimization; • Apply Techniques of optical network survivability. • Demonstrate problem solving skills and critical thinking in the discipline of optical networks. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <p>1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.</p>	
<p>Reference Books:</p> <p>1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.</p>	

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI23/ 16SCE23 16SCN254 / 16SIT23	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Analyze system requirements for mobile applications. • Apply of mobile development frameworks. • Demonstrate mobile application design. • Demonstrate and implement mobile application. 			
Module -1			Teaching Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.			8 Hours
Module -2			
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.			8 Hours
Module – 3			
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API.			8 Hours
Module-4			
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services.			8 Hours
Module-5			
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications			8 Hours
Course outcomes:			
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.
 Each question will have questions covering all the topics under a module.
 The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Mobile Computing: (technologies and Applications-N. N. Jani S chand
2. B.M.Hirwani- Android programming Pearson publications-2013
3. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26 / 16SIT26 / 16SSE26	IA Marks	20
Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
<p>The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.</p>			
<p>Course outcomes:</p> <ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
<p>Conduction of Practical Examination:</p> <p>The student shall prepare the report by including:</p> <ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
<p>Evaluation:</p> <p>Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20</p>			

= 80 marks.

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – II

Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-

CREDITS – 01

Course objectives: This course will enable students to

- Motivate the students to read technical article
- Discover recent technology developments

Descriptions

The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

CLIENT SERVER PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SIT151 / 16LNI41 / 16SCN41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/o. • Define System Calls, Basic I/O Functions available in UNIX • Illustrate socket interface, TCP, UDP in detail. • Compare various client Software and various algorithms issue related to server software design. 			
Module 1			Teaching Hours
The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. Program Interface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.			10 Hours
Module 2			
The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.			10 Hours
Module 3			
Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.			10 Hours
Module 4			
Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs			10 Hours

<p>Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.</p>	
<p>Module 5</p>	
<p>Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/O. • Demonstrate programming System Calls, Basic I/O Functions available in UNIX • Implement Socket interface, TCP, UDP in detail. • Compare and contrast Client Software Various applications and their issues 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. NIL 	

SERVICE ORIENTED ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SSE13 /16SIT153 / 16SCN421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Interpret various architecture for application development • Demonstrate the importance of SOA in Application Integration • To learn web service and SOA related tools • To Learn implementation details of SOA • To understand various case studies 			
Module 1			Teaching Hours
SOA BASICS :Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models.			8 Hours
Module 2			
SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings.			8 Hours
Module 3			
SOA GOVERNANCE: SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software as a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices.			8 Hours
Module 4			
SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB Data binding.			8 Hours
Module 5			
APPLICATION INTEGRATION: JAX –WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Compare different IT architecture • Analyze and design of SOA based applications • Implement web service and realize of SOA • Implement REST full services • Design and implement of SOA based Application Integration using BPEL 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley 2008.

Reference Books:

1. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.
2. Waseem Roshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

ANALYSIS OF COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain with the concepts of computer networks • What is a computer network and what are the fundamental protocols. • Analyze network architectures in stochastic and deterministic way. • Illustrate RSVP, Principles of TCP • Discover more on different network protocols. • Explain multiplexing, streaming sessions in computer network. 			
Module -1			Teaching Hours
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.			8 Hours
Module -2			
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.			8 Hours
Module – 3			
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).			8 Hours
Module-4			
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic			8 Hours
Module-5			
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive			8 Hours

Window Protocol; Bandwidth sharing in a Network.	
Course outcomes:	
On completion, student will be able to:	
<ul style="list-style-type: none"> List and classify network services, protocols and architectures, explain why they are layered. Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.	
Reference Books:	
1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.	
2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999	

NETWORK ROUTING ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> Discuss layered architecture for communication networks and the specific functionality of the network layer. Explain the basic principles of routing and the manner, this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network. Compare and contrast different routing algorithms existing and their performance characteristics. 			

Module -1	Teaching Hours
<p>NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits.</p> <p>Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra’s Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm</p> <p>Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost</p>	8 Hours
Module -2	
<p>ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution</p> <p>OSPF and Integrated IS-IS :From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF</p> <p>Internet Routing Architectures: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability</p>	8 Hours
Module – 3	
<p>Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. IP Address Lookup Algorithms: Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. IP Packet Filtering and Classification: Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.</p>	8 Hours
Module-4	
<p>ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, Ad hoc routing, Mesh routing, Vehicular routing, Sensor routing</p>	8 Hours
Module-5	

<p>TOWARD NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing</p> <p>MPLS and GMPLS: Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. Routing and Traffic Engineering with MPLS: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. VoIP Routing: Interoperability through IP and PSTN : PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<ul style="list-style-type: none"> • Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance. • The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications. 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Deepankar Medhi and Karthikeyan Ramasamy, “Network Routing: Algorithms, Protocols, and Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007 2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons, Inc, © ISTE Ltd 2014 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002. 2. M. Steen Strub, “Routing in Communication network,” Prentice –Hall International, Newyork, 1995. 3. James D. McCabe, “Network Analysis, Architecture, and Design”, 3rd Edition, 2007 Elsevier Inc. 	

WEB MINING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCN424	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Compare and contrast different knowledge discovery issues in Web mining. • Analyze the different algorithms commonly used by Web application. • Apply the role played by Web mining in Information retrieval and extraction • Demonstrate the documents structures and grouping, • Use the probabilistic model for web mining • Illustrate applications using Web mining 			
Module -1			Teaching Hours
<p>INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining . INFRASTRUCTURE and WEB SEARCH -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search.</p>			8 Hours
Module -2			
<p>INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction</p>			8 Hours
Module – 3			
<p>LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding’s – Probabilistic Approaches to clustering – Collaborative Filtering, SUPERVISED LEARNING: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection.</p>			8 Hours
Module-4			

<p>LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISED LEARNING-- Expectation Maximization, Labeling Hypertext Graphs and Co- training.</p>	<p>8 Hours</p>
<p>Module-5</p>	
<p>APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining.</p>	<p>8 Hours</p>
<p>Course outcomes:</p>	
<p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> • Identify the application areas for web content mining, web structure mining and webusage mining. • Design to retrieval the web data • Develop schemes to crawl the web data, organize and index • Cluster the documents for fast access • Develop algorithms used by web mining applications. • Select between different approaches and techniques of web mining 	
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sholom Weiss, “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005 2. Soumen Chakrabarti, “Mining the Web: Discovery Knowledge from Hypertext Data,” Elsevier Science 2003 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Min Song, Yi-fang Brok Wu, “Handbook of Research on Text and Web Mining Technologies”, Vol I & II, Information Science Reference (IGI), 2009 2. K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining Theory and Practice ,” Prentice Hall of India Private Ltd 2006 3. Anthony Scime, “Web Mining Applications and Techniques”, Idea Group Publishing,2005 4. Margret H.Dunham “DATA MINING - Introductory and Advanced Concepts”, PearsonEducation,2003. 	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018-19
M.Tech COMPUTER NETWORK ENGINEERING (SCN)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

I SEMESTER										
Sl. No	Course	Course Code	CourseTitle	Teaching Hours /Week		Direct without Ex	Examination			Credits
							CIE Marks	SEEM marks	Total Marks	
1	PCC	18SCN11	MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE	04	--	03	40	60	100	4
2	PCC	18SCN12	Advances in Computer Networks	04	--	03	40	60	100	4
3	PCC	18SCN13	Information and Network Security	04	--	03	40	60	100	4
4	PCC	18SCN14	Internet of Things	04	--	03	40	60	100	4
5	PEC	18SCN15X	Professional Elective -1	04	--	03	40	60	100	4
6	PCC	18SCNL16	Computer Networks And Iot Laboratory	-	04	03	40	60	100	2
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2
TOTAL				22	04	21	280	420	700	24
Note: PCC: Professional core, PEC: Professional Elective.										
Professional Elective 1										
Course Code under 18SCN15X		Course title								
18SCN152		Multi Core Architecture and Programming								
<p>Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.</p>										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018-19
M.Tech COMPUTER NETWORK ENGINEERING (SCN)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
							CIE Marks	SEE Marks		Total Marks
1	PCC	18SCN21	Multimedia Communications	04	--	03	40	60	100	4
2	PCC	18SCN22	Network Programming	04	--	03	40	60	100	4
3	PCC	18SCN23	Wireless Ad hoc Networks	04	--	03	40	60	100	4
4	PEC	18SCN24X	Professional elective 2	04	--	03	40	60	100	4
5	PEC	18SCN25X	Professional elective 3	04	--	03	40	60	100	4
6	PCC	18SCNL26	Mini Project	--	04	03	40	60	100	2
7	PCC	18SCN27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				20	06	18	340	360	700	24

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 2		Professional Elective 3	
Course Code under 18SCN24X	Course title	Course Code under 18SCN25X	Course title
18SCN241	Advances in Storage Area Network	18SCN252	Managing Big Data

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018-19
M.Tech COMPUTER NETWORK ENGINEERING (SCN)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/Assignment	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	PCC	18SCN31	Cloud Computing	04	--	03	40	60	100	4
2	PEC	18SCN32X	Professional elective4	04	--	03	40	60	100	4
3	PEC	18SCN33X	Professional elective 5	04	--	03	40	60	100	4
4	Project	18SCN34	Evaluation of Project phase -1	--	02	--	100	--	100	2
5	Intenship	18SCNI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	260	240	500	20

Note: PCC: Professional core, PEC: Professional Elective.

Professional elective 4		Professional elective 5	
Course Code under 18SCN32X	Course title	Course Code under 18SCN33X	Course title
18SCN321	Computer Systems Performance Analysis	18SCN331	Analysis of Computer Networks
18SCN322	Network Routing Algorithm	18SCN332	Protocol Engineering
18SCN323	Information Security Policies in Industry	18SCN333	Web Engineering
18SCN324	Machine Learning Techniques	18SCN334	Web Mining

Note:

1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE (University examination) shall be as per the University norms.

2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements.

Internship SEE (University examination) shall be as per the University norms.

VISVESVARAY A TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018- 19
M.Tech COMPUTER NETWORK ENGINEERING (SC N)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Project/Fieldwork/Assignment	Duration in hours	CIE Marks	SEE Marks/Viva voce		Total Marks
1	Project18	SCN41	Project work phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20
<p>Note:</p> <p>1. Project Phase-2:</p> <p>CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.</p> <p>SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.</p>										



MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18SFC11 / 18LNI11 / 18SCE11 / 18SCS11 / 18SCN11 / 18SSE11 / 18SIT11	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • To acquaint the students with mathematical/logical fundamentals including numerical techniques, • To understand probability, sampling and graph theory that serve as an essential tool for applications of computer and information sciences. 			
Module 1			Contact Hours
Numerical Methods: Significant figures, Error definitions, Approximations and round off errors, accuracy and precision. Roots of Equations: Bairstow-Lin’s Method, Graeffe’s Root Squaring Method. Computation of Eigen values of real symmetric matrices: Jacobi and Givensrotation method.			10 Hours
RBT: L1, L2, L3			
Module 2			
Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non linear)			10 Hours
RBT: L1, L2, L3			
Module 3			
Probability Theory: Probability mass function (p.m.f), density function (p.d.f), Random variable: discrete and continuous, Mathematical expectation, Sampling theory: testing of hypothesis by t-test and chi - square distribution.			10 Hours
RBT: L1, L2, L3			
Module 4			
Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycle. Specialized techniques to solve combinatorial enumeration problems.			10 Hours
RBT: L1, L2, L3			
Module 5			
Vector Spaces: Vector spaces; subspaces; Linearly independent and dependent vectors ; Bases and dimension; coordinate vectors-Illustrative examples. Linear transformations; Representation of transformations by matrices; linear functional; Non singular Linear transformations; inverse of a linear transformation- Problems.			10 Hours
RBT: L1, L2, L3			
Course Outcomes			
<ul style="list-style-type: none"> • Emphasize the numerical methods to solve and find the roots of the equations. • Utilize the statistical tools in multi variable distributions. • Use probability formulations for new predictions with discrete and continuous RV’s. • To make use of graphs in different geometries related to edges. • Apply vector spaces and related topics arising in magnification and rotation of images. 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Steven C. Chapra and Raymond P Canale: “Numerical Methods for Engineers”, 7th Edition, McGraw-Hill Publishers, 2015.
2. T.Veerarajan: “Probability, Statistics and Random Process“, 3rd Edition, Tata Mc-Graw Hill Co., 2016.
3. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
2. **John Vince** : “Foundation Mathematics for Computer Science”, Springer International Publishing, Switzerland, 2015
3. **M.K.Jain, S.R.K.Iyengar and R.K.Jain**: Numerical Methods for Scientific and Engineering Computation. 6thEd., New Age Int.Publishers.2012.
4. **Norman L.Biggs**: Discrete Mathematics, 2nd Ed., Oxford University Press, 2017.

Web links and Video Contacts:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>

ADVANCES IN COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18LNI321 / 18SCN12 / 18SCS151	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Discuss with the basics of Computer Networks. • Compare various Network architectures. • Discuss fundamental protocols. • Define and analyze network traffic, congestion, controlling and resource allocation. 			
Module 1			Contact Hours
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4 RBT: L1, L2, L3			10 Hours
Module 2			
Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2, RBT: L1, L2, L3			10 Hours
Module 3			
Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18. RBT: L1, L2, L3			10 Hours
Module 4			
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 RBT: L1, L2, L3			10 Hours
Module 5			
Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web			10 Hours

(HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 RBT: L1, L2, L3	
Course Outcomes The students should be able to: <ul style="list-style-type: none"> • List and classify network services, protocols and architectures, explain why they are layered. • Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. • Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc. • Explain various congestion control techniques. 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: <ol style="list-style-type: none"> 1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014. 2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014. 	
Reference Books: <ol style="list-style-type: none"> 1. Uyles Black, “Computer Networks, Protocols , Standards and Interfaces” 2 nd Edition -PHI. 2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4th Edition – Tata McGraw-Hill. 	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18LNI13 / 18SCN13 / 18SCS322	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Contact Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm RBT: L1, L2, L3			10 Hours
Module 2			Contact Hours
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. RBT: L1, L2, L3			10 Hours
Module 3			Contact Hours
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption,			10 Hours

Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification. RBT: L1, L2, L3	
Module 4 Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol RBT: L1, L2, L3	10 Hours
Module 5 Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. RBT: L1, L2, L3	10 Hours
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> Analyze the vulnerabilities in any computing system and hence be able to design a security solution. Identify the security issues in the network and resolve it. Evaluate security mechanisms using rigorous approaches, including theoretical. 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. William Stallings, Cryptography and Network Security, Pearson 6 th edition.	
Reference Books: 1. V K Pachghare: Cryptography and Information Security.	

INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18LNI22 / 18SCE23 / 18SCN14 / 18SCS14 / 18SSE321	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Contact Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications. RBT: L1, L2, L3			10 Hours
Module -2			Contact Hours
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP), IPSO RBT: L1, L2, L3			10 Hours
Module – 3			Contact Hours
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6. RBT: L1, L2, L3			10 Hours
Module-4			Contact Hours
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications. RBT: L1, L2, L3			10 Hours
Module-5			Contact Hours
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study. RBT: L1, L2, L3			10 Hours

Course outcomes:

At the end of this course the students will be able to:

- Develop schemes for the applications of IOT in real time scenarios
- Manage the Internet resources
- Model the Internet of things to business
- Understand the practical knowledge through different case studies
- Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

WIRELESS NETWORKS AND MOBILE COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI331 / 18SCE241 / 18SCN151 / 18SCS323	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- Explain CDMA, GSM, Mobile IP, Wimax and Different Mobile OS
- Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

Module -1	Contact Hours
<p>Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10Hours
<p>Module -2</p> <p>Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
<p>Module – 3</p> <p>Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
<p>Module-4</p> <p>Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
<p>Module-5</p>	

<p>J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
<p>Course outcomes:</p>	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Explain state of art techniques in wireless communication. • Discover CDMA, GSM, Mobile IP, Wimax • Demonstrate program for CLDC, MIDP let model and security concerns 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010. 2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Raj kamal: Mobile Computing, Oxford University Press, 2007. 2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009. 	

MULTI-CORE ARCHITECTURE AND PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - I			
Subject Code	18SCE22 / 18SCN152 / 18SCS152	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define technologies of multicore architecture and performance measures • Demonstrate problems related to multiprocessing • Illustrate windows threading, posix threads, openmp programming • Analyze the common problems in parallel programming 			
Module -1			Contact Hours
Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.			10 Hours
			RBT: L1, L2, L3
Module -2			
Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features			10 Hours
			RBT: L1, L2, L3
Module – 3			
Threading APIs :ThreadingAPIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.			10 Hours
			RBT: L1, L2, L3
Module-4			
OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions,			10 Hours

OpenMP Environment Variables, Compilation, Debugging, performance	RBT: L1, L2, L3
Module-5	
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.	10 Hours
	RBT: L1, L2, L3
Course outcomes:	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Identify the limitations of ILP and the need for multicore architectures • Define fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Make out the salient features of different multicore architectures and how they exploit parallelism • Demonstrate the role of OpenMP and programming concept 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006 	
Reference Books: NIL	

SOCIAL NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18LNI332 / 18SCN153 /18SFC333	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> The learning objective of the course Social Network Analysis is to discuss essential knowledge of network analysis applicable to real world data, with examples from today’s most popular social networks. 			
Module 1			Contact Hours
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores. <p style="text-align: right;">RBT: L1, L2</p>			10 Hours
Module 2			
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS. <p style="text-align: right;">RBT: L1, L2</p>			10 Hours
Module 3			
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module 4			
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module 5			
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> Define notation and terminology used in network science. Demonstrate, summarize and compare networks. Explain basic principles behind network analysis algorithms. Analyzing real world network. 			
Question paper pattern:			
The question paper will have ten questions.			

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books:

1. NIL

CLOUD SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – I			
Subject Code	18LNI333 / 18SCE331 / 18SCN154 / 18SFC152	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Describe the fundamentals of Cloud Computing. • Summarize the need of cloud compliance and existing cloud solutions. • Explain the cloud security concepts. • Demonstrate the operations of Data Centre. • Distinguish the concepts of Identity management and virtualization. 			
Module 1			Contact Hours
Cloud Computing Architectural Framework: Cloud Benefits, Business scenarios, Cloud Computing Evolution, cloud vocabulary, Essential Characteristics of Cloud Computing, Cloud deployment models, Cloud Service Models, Multi- Tenancy, Approaches to create a barrier between the Tenants, cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, Security for Cloud Computing, How Security Gets Integrated. <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module 2			
Compliance and Audit: Cloud customer responsibilities, Compliance and Audit Security Recommendations. Portability and Interoperability: Changing providers reasons, Changing providers expectations, Recommendations all cloud solutions, IaaS Cloud Solutions, PaaS Cloud Solutions, SaaS Cloud Solutions. <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module 3			
Traditional Security, Business Continuity, Disaster Recovery, Risk of insider abuse, Security baseline, Customers actions, Contract, Documentation, Recovery Time Objectives (RTOs), Customers responsibility, Vendor Security Process (VSP). <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module 4			
Data Center Operations: Data Center Operations, Security challenge, Implement Five Principal Characteristics of Cloud Computing, Data center Security Recommendations. Encryption and Key Management: Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards, Recommendations. <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module 5			
Identity and Access Management: Identity and Access Management in the cloud, Identity and Access Management functions, Identity and Access Management (IAM) Model, Identity Federation, Identity Provisioning Recommendations, Authentication for SaaS and Paas customers, Authentication for IaaS customers, Introducing Identity Services, Enterprise Architecture with IDaaS , IDaaS Security Recommendations. Virtualization: Hardware Virtualization, Software Virtualization, Memory Virtualization, Storage			10 Hours

Virtualization, Data Virtualization, Network Virtualization, Virtualization Security Recommendations.	RBT: L1, L2, L3
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> • Demonstrate the growth of Cloud computing, architecture and different modules of implementation. • Evaluate the different types of cloud solutions among IaaS, PaaS, SaaS. • Access the security implementation flow, actions and responsibilities of stake holders. • Generalize the Data Centre operations, encryption methods and deployment details. • Provide recommendations for using and managing the customer's identity and choose the type of virtualization to be used. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance", Oreilly Media 2009.	
Reference Books:	
1. Vic (J.R.) Winkler, "Securing the Cloud, Cloud Computer Security Techniques and Tactics", Syngress, April 2011.	

COMPUTER NETWORKS AND IOT LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SCNL16	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate Concepts of fundamental protocols.
- Illustrate internetworking concepts.
- Implement concepts in congestion control and error detections.
- Evaluate fundamentals of Cryptography through practical implementation.
- Implement standard algorithms used to provide confidentiality, integrity and authenticity.
- Design security applications in the field of Information technology.

PART – A Computer Network LABORATORY WORK

Note:

Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
2. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
3. Write a program to implement Link State Routing (Dijkstra Algorithm).
4. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
5. Write a program for encrypting 64 bit playing text using DES algorithm.
6. Apply the RSA algorithm on a text file to produce cipher text file.
7. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
8. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output.

Simulation Programs using OPNET /NS2/NS3 or any other equivalent software

9. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
10. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

PART – B IOT LABORATORY WORK

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

Course Outcomes

The students should be able to:

- Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Design and evaluate application layer protocol
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Conduction of Practical Examination:

1. All laboratory experiments (nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from **each part and execute both**
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
4. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

MULTIMEDIA COMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI152 / 18SCE322 / 18SCN21	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the Multimedia Communication Models • Explain Multimedia Transport in Wireless Networks • Solve the Security issues in multimedia networks • Illustrate real-time multimedia network applications. • Explain different network layer based application. 			
Module 1			Contact Hours
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,.Text, images, audio and video.			10 Hours
RBT: L1, L2, L3			
Module 2			
Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG			10 Hours
RBT: L1, L2, L3			
Module 3			
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.			10 Hours
RBT: L1, L2, L3			
Module 4			
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.			10 Hours
RBT: L1, L2, L3			
Module 5			
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.			10 Hours
RBT: L1, L2, L3			
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Deploy the right multimedia communication models. • Apply QoS to multimedia network applications with efficient routing techniques. • Solve the security threats in the multimedia networks. • Develop the real-time multimedia network applications 			
Question paper pattern:			

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Fred Halsall, "Multimedia Communications", Pearson education, 2001.
2. Raif Steinmetz, KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002.

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

NETWORK PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI14 / 18SCE333 / 18SCN22	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define Network Programming. • Demonstrate programming with TCP and SCTP. • Explain key management and routing sockets. • Evaluate advanced Socket Programming APIs. 			
Module 1			Contact Hours
Introduction to network application, client/server communication, OSI Model, BSD Networking history, Test Networks and Hosts, Unix Standards, 64-bit architectures, Transport Layer: TCP, UDP and SCTP.			10 Hours
RBT: L1, L2, L3			
Module 2			10 Hours
Sockets Introduction – socket address structures, value-result arguments, byte ordering and manipulation functions, address conversion functions, Elementary TCP Sockets – socket, connect, bind, listen, accept , fork and concurrent server design, getsockname and getpeername functions and TCP Client/Server Example- client/server programming through TCP sockets, Normal startup, termination, POSIX signal handling, Signal handling in server, Crashing, rebooting of server host, shutdown			10 Hours
RBT: L1, L2, L3			
Module 3			10 Hours
I/O Multiplexing and Socket Options, Elementary SCTP Sockets- Interface Models, sctp_xx functions, shutdown function, Notifications, SCTP Client/Server Examples – One-to-Many, Head-of-Line Blocking, Controlling number of streams and Termination, IPv4 and IPv6 Interoperability–different interoperability scenarios.			10 Hours
RBT: L1, L2, L3			
Module 4			10 Hours
Daemon Processes, syslogd, daemonizing functions and the inetd super server, Advanced I/O functions- readv, writev, sendmsg and recvmsg, Ancillary data, Advanced polling, Unix domain protocols- socket address structure, functions and communication scenarios, Nonblocking I/O – connect and accept examples.			10 Hours
RBT: L1, L2, L3			
Module 5			10 Hours
ioctl operations- socket, file, interface configuration information, ARP cache and routing table operations, Routing sockets- data link socket address structure, reading and writing, sysctl operations, interface name and index functions, Key Management functions – reading, writing, SADB, SA, Dynamically Maintaining SA's, Out-of-Band data, Threads-basic thread functions, TCP echo server using threads, Mutexes and Conditional variables.			10 Hours
RBT: L1, L2, L3			
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Develop applications that communicate with each other using TCP and SCTP. 			

- Identify the IPv4 and IPv6 compatibility.
- Evaluate socket programming APIs.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004.

Reference Books:

1. Barry Nance: "Network Programming in C", PHI 2002 3. Bob Quinn, Dave Shute: "Windows Socket Network Programming", Pearson 2003.
2. Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition.

WIRELESS AD-HOC NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - II			
Subject Code	18LNI241 / 18SCN23	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain fundamental principles of Ad-hoc Networks • Discuss a comprehensive understanding of Ad-hoc network protocols • Outline current and emerging trends in Ad-hoc Wireless Networks. • Analyze energy management in ad-hoc wireless networks. 			
Module -1			Contact Hours
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas. RBT: L1, L2, L3			10 Hours
Module -2			
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols. RBT: L1, L2, L3			10 Hours
Module – 3			
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols. RBT: L1, L2, L3			10 Hours
Module-4			
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks. RBT: L1, L2, L3			10 Hours
Module-5			
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes,			10 Hours

Transmission Management Schemes, System Power Management Schemes.	RBT: L1, L2, L3
Course outcomes:	
The students shall able to: <ul style="list-style-type: none"> • Design their own wireless network • Evaluate the existing network and improve its quality of service • Choose appropriate protocol for various applications • Examine security measures present at different level • Analyze energy consumption and management 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2 nd Edition, Pearson Education, 2011	
Reference Books:	
1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007. 2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004. 3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002	

ADVANCES IN STORAGE AREA NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI243 / 18SCE323 / 18SCN241 / 18SCS241 / 18SIT253 / 18SSE153	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define and contrast storage centric and server centric systems • Define metrics used for Designing storage area networks • Illustrate RAID concepts • Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems. 			
Module 1			Contact Hours
Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. RBT: L1, L2, L3			10 Hours
Module 2			
I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. RBT: L1, L2, L3			10 Hours
Module 3			
Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network. RBT: L1, L2, L3			10 Hours
Module 4			
SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs. RBT: L1, L2, L3			10 Hours
Module 5			
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized			10 Hours

<p>Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Identify the need for performance evaluation and the metrics used for it • Apply the techniques used for data maintenance. • Realize strong virtualization concepts • Develop techniques for evaluating policies for LUN masking, file systems 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011. 2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005. 3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006. 	

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18SCN242	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain switching and multiplexing. • Analyze the transmission technology. And transmission control. • Demonstrate basic knowledge on telecommunication 			
Module -1			Contact Hours
Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks			10 Hours
RBT: L1, L2, L3			
Module -2			10 Hours
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization			10 Hours
RBT: L1, L2, L3			
Module – 3			10 Hours
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing			10 Hours
RBT: L1, L2, L3			
Module-4			10 Hours
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching			10 Hours
RBT: L1, L2, L3			
Module-5			10 Hours
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems			10 Hours
RBT: L1, L2, L3			
Course outcomes:			
The student will be able to:			
<ul style="list-style-type: none"> • Explain basics of telecommunications and digital form • Elaborate switching and multiplexing, telecommunication. • Illustrate transmission control in telecommunication • Design and develop switching, multiplexing and traffic control. 			
Question paper pattern:			

- The question paper will have ten questions.
- There will be 2 questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Reference Books:

<p align="center">ETHERNET TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II</p>			
Subject Code	18LNI153 / 18SCN243	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define with the basics of Ethernet • Explain concepts of different types of Ethernet • Analyze building an Ethernet system • Acquire knowledge of hubs and repeaters 			
Module 1			Teaching Hours
Introduction: Introduction to Ethernet, The Evolution of Ethernet, The Ethernet System, The Media Access Control Protocol The media Access Control Protocol Full Duplex Ethernet Auto-Negotiation <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 2			
Ethernet Media Systems: Ethernet Media Fundamentals Twisted-Pair Media System(10Base-T) Fiber Optic Media System(10Base-F) Fast Ethernet Twisted-Pair Media System(100Base-TX) <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 3			
Fast Ethernet Fiber Optic Media System(100Base-FX) Gigabit Ethernet Twisted-Pair Media System(1000Base-T) Gigabit Ethernet Fiber Optic Media System (1000Base-X) <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 4			
Multi-Segment Configuration Guidelines Building Your Ethernet System: structured Cabling Twisted-Pair Cables and Connectors Fiber Optic Cables and Connectors <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 5			

Ethernet Repeater Hubs Ethernet Switching Hubs Performance and troubleshooting: Ethernet Performance Troubleshooting. <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> • Classify different types of Ethernet systems • Contrast Ethernet Media systems • Evaluate a complete Ethernet system 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Charles E. Spurgeon: "Ethernet – The Definitive Guide", O'Reilly 2004.	
Reference Books: 1. Rich Seifert: "Gigabit Ethernet", Addison-Wesley 1998.	

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI323/ 18SCN244 18SFC332 / 18SIT241	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Analyze system requirements for mobile applications. • Apply of mobile development frameworks. • Demonstrate mobile application design. • Demonstrate and implement mobile application. 			
Module -1			Contact Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module -2			
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module – 3			
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-4			
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet, Entertainment, and Services. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-5			
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Course outcomes:			
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements 			

- Implement the design using Android SDK
- Implement the design using Objective C and iOS
- Deploy mobile applications in Android and iPone marketplace for distribution

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Mobile Computing: (technologies and Applications-N. N. Jani S chand
2. B.M.Hirwani- Android programming Pearson publications-2013
3. W. Frank Ableson, Robi Sen and C. E. Ortiz - **Android in Action**, Third Edition-2012 DreamTech Publisher

WIRELESS SENSOR NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI324 /18SCE251 / 18SCN251	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain sensor networks for various application setups. • Demonstrate the design space and conduct trade-off analysis between performance and resources. • Assess coverage and conduct node deployment planning. • Devise appropriate data dissemination protocols and model links cost. • Determine suitable medium access protocols and radio hardware. • Illustrate sensor networks using commercial components. • Discuss quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints. 			
Module -1			Contact Hours
Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. (Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)			10 Hours
RBT: L1, L2, L3			
Module -2			
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies (Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)			10 Hours
RBT: L1, L2, L3			
Module – 3			
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. (Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)			10 Hours
RBT: L1, L2, L3			
Module-4			
Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware. (Chapter 7: 7.1-7.4, Chap. 8: 8.1-8.4)			10 Hours
RBT: L1, L2, L3			
Module-5			

<p>Network Management and Operating System for Wireless Sensor Networks: Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. (Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
<p>Course outcomes:</p>	
<p>The students shall able to:</p> <ul style="list-style-type: none"> • Explain existing applications of wireless sensor actuator networks • Apply in the context of wireless sensor networks and explain elements of distributed computing and network protocol design • Contrast Various hardware, software platforms that exist for sensor networks • Summarize various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications:, WILEY , Second Edition (Indian) , 2014 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010 2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007. 	

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI251 / 18SCE21 / 18SCN252 / 18SCS21 / 18SFC331 / 18SIT31 / 18SSE322	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Contact Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics. RBT: L1, L2, L3			10 Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations. RBT: L1, L2, L3			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures. RBT: L1, L2, L3			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats RBT: L1, L2, L3			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data			10 Hours

definition – HiveQL data manipulation – HiveQL queries.	RBT: L1, L2, L3
Course outcomes:	
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS • Perform map-reduce analytics using Hadoop • Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012. 2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012. 	
Reference Books:	
<ol style="list-style-type: none"> 1. VigneshPrajapati, Big data analytics with R and Hadoop, SPD 2013. 2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012. 3. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011. 4. Alan Gates, "Programming Pig", O'Reilly, 2011 	

NETWORK MANAGEMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18LNI154 / 18SCN253	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Evaluate need for interoperable network management. • Explain the concepts and architecture behind standards based network management. • Illustrate the concepts and terminology associated with SNMP and TMN • Demonstrate network management as a typical distributed application 			
Module 1			Contact Hours
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. RBT: L1, L2, L3			10 Hours
Module 2			Contact Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. RBT: L1, L2, L3			10 Hours
Module 3			Contact Hours
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. RBT: L1, L2, L3			10 Hours
Module 4			Contact Hours
Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC			10 Hours

Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles	
RBT: L1, L2, L3	
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management.	10 Hours
RBT: L1, L2, L3	
Course Outcomes	
The students should be able to:	
<ul style="list-style-type: none"> • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.	
Reference Books:	
1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.	

ADVANCES IN OPERATING SYSTEMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – II			
Subject Code	18SCS12 / 18SCN254	IA Marks	40

Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define the fundamentals of Operating Systems. • Explain distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols • Illustrate distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols • Identify the components and management aspects of Real time, Mobile operating Systems 			
Module 1			Teaching Hours
Operating System Overview, Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues. RBT: L1, L2, L3			10 Hours
Module 2			
Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management, Summary RBT: L1, L2, L3			10 Hours
Module 3			
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSI) Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock RBT: L1, L2, L3			10 Hours
Module 4			
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits. RBT: L1, L2, L3			10 Hours
Module 5			
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management,Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management. The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization,Traps,Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager Kernel local procedure calls and IPC, The native API, subsystems. RBT: L1, L2, L3			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of 			

<ul style="list-style-type: none"> • Distributed operating system • Learn the various resource management techniques for distributed systems • Identify the different features of real time and mobile operating system • Modify existing open source kernels in terms of functionality or features used
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013. 2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008 2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006. 3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

<p>CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – III</p>			
Subject Code	18LNI151 / 18SCE14 / 18SCN31 / 18SCS23 / 18SIT22 / 18SSE251	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define and Cloud, models and Services. • Compare and contrast programming for cloud and their applications • Explain virtuaization, Task Scheduling algorithms. • Apply ZooKeeper, Map-Reduce concept to applications. 			
Module 1			Contact Hours
<p>Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in,</p>			10 Hours

Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems. RBT: L1, L2, L3	
Module 2	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing. RBT: L1, L2, L3	10 Hours
Module 3	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems RBT: L1, L2, L3	10 Hours
Module 4	
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems. RBT: L1, L2, L3	10 Hours
Module 5	
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems. RBT: L1, L2, L3	10 Hours
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> • Compare the strengths and limitations of cloud computing • Identify the architecture, infrastructure and delivery models of cloud computing • Apply suitable virtualization concept. • Choose the appropriate cloud player • Address the core issues of cloud computing such as security, privacy and interoperability • Design Cloud Services • Set a private cloud 	
Question paper pattern:	

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

Reference Books:

1. RajkumarBuyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

<p align="center">COMPUTER SYSTEMS PERFORMANCE ANALYSIS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – III</p>			
Subject Code	18SCE151 / 18SCN321 / 18SCS154	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Discuss mathematical foundations needed for performance evaluation of computer systems • Illustrate metrics used for performance evaluation • Develop the analytical modeling of computer systems • Develop new queuing analysis for both simple and complex systems • Analyze techniques for evaluating scheduling policies 			
Module 1			Contact Hours
<p>Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.</p> <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 2			
<p>Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.</p> <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 3			
<p>Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.</p> <p align="right">RBT: L1, L2, L3</p>			10 Hours
Module 4			
<p>Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.</p>			10 Hours

RBT: L1, L2, L3	
Module 5	
<p>Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course Outcomes	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Identify the need for performance evaluation and the metrics used for it • Implement Little's law and other operational laws • Apply the operational laws to open and closed systems • Use discrete-time and continuous-time Markov chains to model real world systems • Develop analytical techniques for evaluating scheduling policies 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003. 2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001. 	

<p style="text-align: center;">NETWORK ROUTING ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III</p>			
Subject Code	18LNI334 / 18SCN322	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Discuss layered architecture for communication networks and the specific functionality of the network layer. • Explain the basic principles of routing and the manner, this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network. • Compare and contrast different routing algorithms existing and their performance characteristics. 			
Module -1			Contact Hours
<p>NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits.</p> <p>Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra’s Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm</p> <p>Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost</p> <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module -2			
<p>ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution</p> <p>OSPF and Integrated IS-IS :From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF</p> <p>Internet Routing Architectures: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability</p>			10 Hours

RBT: L1, L2, L3	
Module – 3	
<p>Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. IP Address Lookup Algorithms: Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. IP Packet Filtering and Classification: Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Module-4	
<p>ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, Ad hoc routing, Mesh routing, Vehicular routing, Sensor routing</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Module-5	
<p>TOWARD NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing</p> <p>MPLS and GMPLS: Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. Routing and Traffic Engineering with MPLS: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. VoIP Routing: Interoperability through IP and PSTN : PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course outcomes:	
<ul style="list-style-type: none"> • Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance. • The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications. 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Deepankar Medhi and Karthikeyan Ramasamy, "Network Routing: Algorithms, Protocols, and 	

Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007

2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons, Inc, © ISTE Ltd 2014

Reference Books:

1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002.
2. M. Steen Strub, “Routing in Communication network,” Prentice –Hall International, Newyork, 1995.
3. James D. McCabe, “Network Analysis, Architecture, and Design”, 3rd Edition, 2007 Elsevier Inc.

INFORMATION SECURITY POLICIES IN INDUSTRY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SCN323 / 18SFC243	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
The objectives of this course is to make students to learn <ul style="list-style-type: none"> • Explain management’s responsibilities and role in the development, maintenance, and enforcement of information security policy, standards, practices, procedures, and guidelines. • Illustrate the differences between the organization’s general information security policy and the needs and objectives of the various issue-specific and system-specific policies the organization will create. • Know what an information security blueprint is and what its major components are. • How an organization institutionalizes its policies, standards, and practices using education, training and awareness programs. • Become familiar with what viable information security architecture is, what it includes, and how it is used. 			
Module 1			Contact Hours
Introduction to Information Security Policies: About Policies, why Policies are Important, When policies should be developed, How Policy should be developed, Policy needs, Identify what and from whom it is being protected, Data security consideration, Backups, Archival storage and disposal of data, Intellectual Property rights and Policies, Incident Response and Forensics, Management Responsibilities, Role of Information Security Department, Security Management and Law Enforcement, Security awareness training and support. RBT: L1, L2, L3			10 Hours
Module 2			Contact Hours
Policy Definitions, Standards, Guidelines, Procedures with examples, Policy Key elements, Policy format and Basic Policy Components, Policy content considerations, Program Policy Examples, Business Goal Vs Security Goals, Computer Security Objectives, Mission statement Format, Examples, Key roles in Organization, Business Objectives, Standards: International Standards. RBT: L1, L2, L3			10 Hours
Module 3			Contact Hours
Writing The Security Policies: Computer location and Facility construction, Contingency Planning, Periodic System and Network Configuration Audits, Authentication and Network Security, Addressing and Architecture, Access Control, Login Security, Passwords, User Interface, Telecommuting and Remote Access, Internet Security Policies, Administrative and User Responsibilities, WWW Policies, Application Responsibilities, E-mail Security Policies. RBT: L1, L2, L3			10 Hours
Module 4			Contact Hours
Establishing Type of Viruses Protection: Rules for handling Third Party Software, User Involvement with Viruses, Legal Issues, Managing Encryption and Encrypted data, Key			10 Hours

<p>Generation considerations and Management, Software Development policies, Processes Testing and Documentation, Revision control and Configuration management, Third Party Development, Intellectual Property Issues.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	
Module 5	
<p>Maintaining the Policies: Writing the AUP, User Login Responsibilities, Organization's responsibilities and Disclosures, Compliance and Enforcement, Testing and Effectiveness of Policies, Publishing and Notification Requirements of the Policies, Monitoring, Controls and Remedies, Administrator Responsibility, Login Considerations, Reporting of security Problems, Policy Review Process, The Review Committee, Sample Corporate Policies, Sample Security Policies.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course Outcomes	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Explain the content, need, and responsibilities of information security policies. • Explain the standards, guidelines, Procedures, and key roles of the organization. • Able to write policy document for securing network connection and interfaces. • Explain the threats to the stored data or data in transit and able to write policy document. • Able to write, monitor, and review policy document. 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. Scott Barman, Writing Information Security Policies, Sams Publishing, 2002. 2. Thomas.R.Peltier, Information Policies, Procedures and Standards, CRC Press, 2004. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Thomas R Peltier, Justin Peltier, John Backley, " Information Security Fundamentals", Auerbach publications, CRC Press, 2005. 2. Harold F. Tipton and Micki Krause "Information Security Management Handbook", Auerbach publications, 5th Edition, 2005. 	

MACHINE LEARNING TECHNIQUES [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III			
Subject Code	18LNI322 / 18SCE321 / 18SCN324 / 18SCS31 / 18SFC254 / 18SIT322 / 18SSE334	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain basic concepts of learning and decision trees. • Compare and contrast neural networks and genetic algorithms • Apply the Bayesian techniques and instant based learning • Examine analytical learning and reinforced learning 			
Module -1			Contact Hours
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search RBT: L1, L2, L3			10Hours
Module -2			
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. RBT: L1, L2, L3			10 Hours
Module – 3			
BAYESIAN AND COMPUTATIONAL LEARNING Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. RBT: L1, L2, L3			10 Hours
Module-4			
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution RBT: L1, L2, L3			10 Hours
Module-5			
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning RBT: L1, L2, L3			10 Hours
Course outcomes:			
On Completion of the course, the students will be able to			

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. EthemAlpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

ANALYSIS OF COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III			
Subject Code	18SCN331	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain with the concepts of computer networks • What is a computer network and what are the fundamental protocols. • Analyze network architectures in stochastic and deterministic way. • Illustrate RSVP, Principles of TCP • Discover more on different network protocols. • Explain multiplexing, streaming sessions in computer network. 			
Module -1			Contact Hours
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module -2			Contact Hours
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module – 3			Contact Hours
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued). <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-4			Contact Hours
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little’s theorem, Brumelle’s theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-5			Contact Hours
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet’s Adaptive Window Protocol; Bandwidth sharing in a Network. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours

RBT: L1, L2, L3

Course outcomes:

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

Reference Books:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

<p style="text-align: center;">PROTOCOL ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III</p>			
Subject Code	18LNI23 / 18SCN332	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain Protocol Engineering fundamentals • Define SDL notations • Demonstrate various protocol conformance testing schemes • Explain Protocol Synthesis and Protocol Re-synthesis 			
Module -1			Contact Hours
Introduction: Communication Model, Communication Software, Communication Subsystems, Communication Protocol, Communication Protocol Development Methods, Protocol Engineering Process. Layered Architecture, Network Services and Interfaces, Protocol Function, OSI Model, TCP/IP Protocol Suite, Application Protocols, Protocol Specification: Components of Protocol to be Specified, Communication Service Specification, Protocol Entity Specification, Interface Specifications, Multimedia Protocol Specifications, Internet Protocol Specifications: Examples <p style="text-align: right;">RBT: L1, L2, L3</p>			10Hours
Module -2			
SDL: Examples of SDL Based Protocol Specifications Introduction to Other Protocol Specification Languages. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module - 3			
Protocol Verification/Validation: Protocol Verification, Verification of a Protocol Using Finite State Machines, Protocol Validation, Protocol Design Errors, Protocol Validation Approaches, and SDL based Protocol Verification, SDL based Protocol Validation <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-4			
Protocol Conformance Testing: Conformance Testing, Conformance Testing Methodology and Framework, Conformance Test Architectures, Test Sequence Generation Methods, Distributed Architecture by Local Methods, Conformance Testing with TTCN, Conformance Testing in Systems with Semi-controllable Interfaces, Conformance Testing of RIP, Multimedia Applications Testing, SDL Based Tools for Conformance Testing, SDL Based Conformance Testing of MPLS. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Module-5			
Protocol Synthesis: Protocol Synthesis, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis. Protocol Implementation: Requirements of Protocol Implementation, Object based approach to Protocol Implementation, Protocol Compilers, and Tools for Protocol Engineering. <p style="text-align: right;">RBT: L1, L2, L3</p>			10 Hours
Course outcomes:			
The students should be able to:			

- Describe the requirements for protocol engineering systems
- Explain the challenges in designing protocol engineering systems
- Implement the design using SDL

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Venkataram&Manvi, PallapaVenkataramSunilkumar S. Manvi, "Communication Protocol Engineering", PHI Learning Pvt. Ltd., 2004.

Reference Books:

1. MiroslavPopovic, "Communication Protocol Engineering", CRC Press, 2006.
2. Konig, Hartmut, "Protocol Engineering", Springer, 2012.

WEB ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III			
Subject Code	18SCN333 / 18SIT324	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS - 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Demonstrate modeling and requirements of a web application. • Develop technology-Aware Web Application. • Illustrate the web application development Process. • Analyze the performances of web applications 			
Module -1			Contact Hours
Introduction: Motivation, Categories of web applications, Characteristics of web applications. Requirements Engineering: Introduction, Fundamentals, RE specifics in web engineering, Principles of RE for web applications, Adapting RE methods to web application development, Outlook. Modeling Web Application: Introduction, Fundamentals, Modeling specifics in web engineering, Modeling requirements, Content modeling, Hypertext modeling, Presentation modeling, Customization modeling, Methods and tools, Outlook. RBT: L1, L2, L3			10 Hours
Module -2			Contact Hours
Web Application Architectures: Introduction, Fundamentals, Specifics of web application architectures, Components of a generic web application architecture, Layered architectures, Data-aspect architectures. Technology-Aware Web Application Design: Introduction, Web design from an evolutionary perspective, Presentation design, Interaction design, Functional design, Outlook. Technologies for Web Applications: Introduction, Fundamentals, Client/Server communication on the web, Client side technologies, Document-specific technologies, Server-side technologies, Outlook. RBT: L1, L2, L3			10 Hours
Module – 3			Contact Hours
Testing Web Applications: Introduction, Fundamentals, Testing specifics in web engineering, Test approaches, Test scheme, Test methods and techniques, Test automation, Outlook. Operation and Maintenance of Web Applications: Introduction, Challenges following the launch of a web application, Content management, Usage analysis, Outlook. Web Project Management: From software project management to web project management, Challenges in web project management, Managing web teams, Managing the development process of a web application, Outlook. RBT: L1, L2, L3			10 Hours
Module-4			Contact Hours
The Web Application Development Process: Motivation, Fundamentals, Requirements for a web application development process, Analysis of the rational unified process, Analysis of extreme programming, Outlook. Usability of Web Applications: Motivation, What is usability? What characterizes the usability of web applications? Design guidelines, Web usability engineering methods, Web usability engineering trends, Outlook. RBT: L1, L2, L3			10 Hours
Module-5			

<p>Performance of Web Applications: Introduction, What is performance? What characterizes performance of web applications, System definition and indicators, Characterizing the work load, Analytical techniques, Representing and interpreting results, Performance optimization methods, Outlook. Security for web Applications: Introduction, Aspects of security, Encryption, digital signatures, and certificates, Secure Client/Server interaction, Client security issues, Service provider security issues, Outlook. The Semantic Web: Fundamentals of the semantic web, Technological concepts, Specifics of semantic web applications, Tools, Outlook.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course outcomes:	
<p>Students will be able to</p> <ul style="list-style-type: none"> • Ability to Model the requirements of a web application. • Contrast technology-aware Web Application. • Ability to analyze the performances of web applications 	
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. GertiKappel, Birgit Proll, SiegfriedReich, Werner Retschitzgeer (Editors): Web Engineering, Wiley India, 2007. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Roger Pressman, David Lowe: Web Engineering: A Practitioner’s Approach, McGraw Hill, 2008. 	

WEB MINING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER - III			
Subject Code	18SCN334 / 18SSC331	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Compare and contrast different knowledge discovery issues in Web mining. • Analyze the different algorithms commonly used by Web application. • Apply the role played by Web mining in Information retrieval and extraction • Demonstrate the documents structures and grouping, • Use the probabilistic model for web mining • Illustrate applications using Web mining 			
Module -1			Contact Hours
INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining . INFRASTRUCTURE and WEB SEARCH -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search. <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module -2			
INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module – 3			
LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding’s – Probabilistic Approaches to clustering – Collaborative Filtering, SUPERVISED LEARNING: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection. <div style="text-align: right;">RBT: L1, L2, L3</div>			10 Hours
Module-4			
LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISEDLEARNING -- Expectation Maximization, Labeling Hypertext Graphs and Co- training.			10 Hours

RBT: L1, L2, L3	
Module-5	
<p>APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining.</p> <p style="text-align: right;">RBT: L1, L2, L3</p>	10 Hours
Course outcomes:	
<p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> • Identify the application areas for web content mining, web structure mining and webusage mining. • Design to retrieval the web data • Develop schemes to crawl the web data, organize and index • Cluster the documents for fast access • Develop algorithms used by web mining applications. • Select between different approaches and techniques of web mining 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<ol style="list-style-type: none"> 1. Sholom Weiss, “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005 2. SoumenChakrabarti, “Mining the Web: Discovery Knowledge from Hypertext Data,” Elsevier Science 2003 	
Reference Books:	
<ol style="list-style-type: none"> 1. Min Song, Yi-fang Brrok Wu, “Handbook of Research on Text and Web Mining Technologies”, Vol I & II, Information Science Reference (IGI), 2009 2. K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining Theory and Practice ,” Prentice Hall of India Private Ltd 2006 3. Anthony Scime, “Web Mining Applications and Techniques”, Idea Group Publishing,2005 4. Margret H.Dunham “DATA MINING - Introductory and Advanced Concepts”, PearsonEducation,2003. 	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

I Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam	
12SCS11	Computer Networks	04	02#	03	50	100	150
12SCS12	Advances in Operating Systems	04	02*	03	50	100	150
12SCS13	Advances in Database Management Systems	04	02*	03	50	100	150
12SCS14	Computer Systems Performance Analysis	04	02#	03	50	100	150
12SCS15x	Elective – I	04	02	03	50	100	150
12SCS16	Seminar	--	03	--	50	--	50
Total		20	13	15	300	500	800

Elective I

12SCS154 Embedded Systems

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

II Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam	
12SCS21	Formal Models in Computer Science	04	2*	03	50	100	150
12SCS22	Advanced Algorithms	04	2*	03	50	100	150
12SCS23	Advances in Computer Architecture	04	2#	03	50	100	150
12SCS24	Cloud Computing	04	2#	03	50	100	150
12SCS25x	Elective – II	04	2	03	50	100	150
	**Project Phase-I(6 Week Duration)				--		--
12SCS26	Seminar		03		50	--	50
Total		20	13	15	300	500	800

Elective – II

12SCS253 Protocols Engineering

**** Between the II Semester and III Semester after availing a vocation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

III Semester

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam	
12SCS31	Information Security	4	--	3	50	100	150
12SCS32x	Elective-III	4	2	3	50	100	150
12SCS33x	Elective-IV	4	2	3	50	100	150
12SCS34	Project Phase-II		§				
12SCS35	Evaluation of Project Phase – I	–	3	–	50	–	50
Total		12	07	09	200	300	500

Elective – III

12SCS322 Advances in Storage Area Networks

Elective – IV

12SCS331 Analysis of Computer Networks

§ 3 Days Course work and 3 days for Project work

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

IV Semester

Course Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
12SCS41	Evaluation of Project Phase – II	-	-	-	50	-	50
12SCS42	Evaluation of Project work – III	-	-	-	50	-	50
12SCS43	Project work evaluation and Viva-voce	-	-	3	-	100+100	200
	Total	-	-	03	100	200	300
Grand Total (I to IV Sem.) : 2400							

Note: Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

Note:

- * Lab Classes for any two core subjects are compulsory (practical will be evaluated for 20 marks and internal assessment for 30 marks. Lab journals should be maintained).
 - # For the remaining two core subjects, it can be field work, assignment, tutorials.
- 1) Project Phase – I : 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation. Evaluation of the same shall be taken up during beginning of III Semester. Total Marks shall be 50. Colleges have to send the synopsis after Phase – I.
 - 2) Project Phase – II : 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 50.
 - 3) Project Phase – III : 24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. Total Marks shall be 50. At the end of the Semester Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be $50 + 50 + 100 = 200$ (50 marks for guide, 50 marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The Marks of Project Phase – I shall be sent to the University along with III Semester I.A. Marks of other subjects.
 - The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).

M. Tech in Computer Science and Engineering

I SEMESTER

COMPUTER NETWORKS

Subject Code: 12SCS11

Hours/Week : 04

Total Hours : 52

I.A. Marks : 50

Exam Hours: 03

Exam Marks: 100

1. Review of Basic Concepts: Building a Network; Requirements- Connectivity, Cost-Effective Resource Sharing, Support for Common Services; Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture; Performance- Bandwidth and Latency, Delay \times Bandwidth Product, High-Speed Networks.

2. Direct link networks: Hardware Building Blocks-nodes, links; error Detection- Two-Dimensional Parity, Internet checksum Algorithm, cyclic Redundancy Check; reliable Transmission- Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Rings (802.5, FDDI) –Token Ring Media Access Control, Token Ring Maintenance, FDDI.

3. Packet Switching: Switching and forwarding – Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches – Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges; cell switching (ATM) – Cells, Segmentation and Reassembly, Virtual Paths, Physical Layers for ATM.

4. Internetworking: Simple internetworking (IP) – What Is an Internetwork?, Service Model, Global Address, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels; Routing – Network as a Graph, distance Vector(RIP), Link State(OSPF), Metrics, Routing for Mobile Hosts, Global Internet – Subnetting, Classless Routing(CIDR), Interdomain Routing(BGP), Routing Areas, IP Version 6(IPv6).

5. End –to-End Protocols: Simple demultiplexer (UDP); Reliable byte stream (TCP) – End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Alternative Design Choices.

6. Congestion Control and Resource Allocation: Issues in resource allocation – Network Model, Taxonomy, Evaluation Criteria; Queuing discipline – FIFO, Fair Queuing; TCP Congestion Control – Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion-Avoidance mechanisms – DECBIT, Random Early Detection (RED), Source-Based Congestion Control.

7. Applications: Traditional applications – Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Name Service (DNS), Network management (SNMP); Web services – Custom APPLICATION Protocols (WSDL, SOAP), A Generic application Protocol (REST).

Laboratory Work:

Using any Protocol Analyzer like Ethereal, perform the following experiments:

1. Capture the packets that are transmitted after clicking on the URL of the web site of your college. Analyze the packets at the highest level and prepare a brief report of your analysis.
2. Analyze the data captured above at lower levels and demonstrate the layering of the protocols.
3. Capture the packets in the LAN, & filter for a unique subscriber
4. Capture the ARP packets and find the MAC addresses in the LAN in your laboratory.

Using either NS228/OPNET or any other suitable simulator, perform the following experiments:

1. Simulate an Ethernet LAN using 10 node , change error rate and data rate , and compare throughput
2. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Implement the following in C/C++:

1. Write a program for distance vector algorithm to find suitable path for transmission.
2. Write a program for error detecting code using CRC-CCITT (16-bit)
3. Write a program for congestion control using leaky bucket algorithm.

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

Advances in Operating Systems

Subject Code : 12SCS12

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction, Review Operating Systems Strategies: User' perspectives, technologies and examples of Batch Systems, Timesharing Systems, Personal computer systems, Embedded systems, and small communicating computers; The genesis of modern operating systems.

2. Using the Operating Systems The programmer's abstract machine; Resources; Processes and threads; Writing concurrent programs.

3. Operating Systems Organization Basic functions; General implementation considerations; Contemporary OS kernels.

4. Design Strategies Design considerations; Monolithic kernels; Modular organization; Microkernel; Layered organizations; Operating Systems for distributed system.

5. Real World Examples Linux, Windows NT/2000/XP: Process descriptors, Thread descriptors, Thread scheduling. Linux, Windows NT/2000/XP: Kernel

6. Distributed Systems: Networking; The Need for a Protocol Architecture; The TCP/IP Sockets; Linux Networking; Client/Server Computing; Distributed Message Passing; Remote Procedure Calls; Clusters; Windows Vista Cluster Server; Linux Clusters; Distributed Process Management; Process Migration; Distributed Global States; Distributed Mutual Exclusion; Distributed Deadlock.

Laboratory Work: (The following programs can be executed on any available and suitable platform)

1. Design, develop and execute a program using any thread library to create the number of threads specified by the user; each thread independently generates a random integer as an upper limit, and then computes and prints the number of primes less than or equal to that upper limit along with that upper limit.

2. Rewrite above program such that the processes instead of threads are created and the number of child processes created is fixed as two. The program should make use of kernel timer to measure and print the real time, processor time, user space time and kernel space time for each process.

3. Design, develop and implement a process with a producer thread and a consumer thread which make use of a bounded buffer (size can be prefixed at a suitable value) for communication. Use any suitable synchronization construct.

4. Design, develop, and execute a program to solve a system of n linear equations using Successive Over-relaxation method and n processes which use Shared Memory API. 5. Design, develop, and execute a program to demonstrate the use of RPC.

Text Books:

1. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2004.
2. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2008.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007.

Advances in Database Management Systems

Subject Code : 12SCS13
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.
2. Object and Object-Relational Databases: Overview of Object-Oriented Concepts – Objects, Encapsulation, Type and class hierarchies, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.
3. Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts.
4. Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.
5. Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support; View materialization; Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.
6. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

Laboratory Work:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.
2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:

a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.

b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2007.

2. Raghuram Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

2. Connolly and Begg: Database Systems, 4th Edition, Pearson Publications, 2005.

Computer Systems Performance Analysis

Subject Code : 12SCS14

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

2. Workloads, Workload Selection and Characterization: Types of Work loads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

3. Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid

monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

4. Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs.

5. Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

6. Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2007.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.

2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Advances in Digital Image Processing

Subject Code : 12SCS151

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

2. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.
3. Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
4. Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.
5. Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.
6. Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.
7. Image Transformation: Discrete Cosine Transforms, Walsh Hadamard Transforms, Wavelet Transforms and Multiprocessing, Background, Multiresolution Expansions, Wavelet Transforms in one Dimension, Wavelet Transforms in Two Dimensions, Wavelet Packets, an overview of Second Generation Wavelet Transforms.
8. Image and Video Compression: Fundamentals, Image Compression Models, Lossless compression Methods: Huffman coding, run length coding, LZ coding, Arithmetic coding, Lossy Compression: Gray level Run length coding, Block truncation coding, vector quantization, Differential predictive coding, Transform coding , Hybrid coding, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 .
9. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.
10. Image Segmentation and Object Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005
2. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997

REFERENCES:

1. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
2. Z. Li and M.S. Drew: Fundamentals of Multimedia, Pearson, 2004.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, TataMcGraw Hill, 2004.

Computer Graphics and Visualization

Subject Code : 12SCS152
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two-dimensional applications.

2. The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

3. Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

4. Geometric Objects and Transformations: Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

5. Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Projections and shadows.

6. Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Computation of vectors; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

7. Curves and surfaces: Representation of curves and surfaces; Design criteria; Parametric cubic polynomial curves; Interpolation; Hermite curves and surfaces; Bezier curves and surfaces; Cubic B-Splines; General B-Splines; Rendering curves and surfaces; Curves and surfaces in OpenGL.

Text Book:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson, 2009.

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 2nd Edition, Pearson, 2004.

2. F.S. Hill,Jr.: "Computer Graphics Using OpenGL", 2nd Edition, Pearson, 2001.

3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-Wesley 1997.

OPTICAL NETWORKS

Subject Code : 12SCS153
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Client Layers of the Optical Layer

SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

2. WDM Network Elements

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.

3. Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. Configuration Management: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

4. Basic Concepts

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

5. WDM Network Design

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model, Maximum Load Dimensioning Models: Offline Light path Requests, Online RWA in Rings.

Text Book

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

Embedded Systems

Subject Code : 12SCS154
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Custom single-purpose processor design; RT level custom single-purpose processor design, optimizing custom single-purpose processors: Optimizing the original program, optimizing the FSM, Optimizing the data path, optimizing the FSM.
2. Timers, counters, and watchdog timers. State machine models: introduction; An introductory example, A basic state machine model: finite-state machines(FSM);finite-state machines with data path model (FSMD);using state machines: Describing a system as a state machine, Comparing state machine and sequential program models, Capturing a state machine model in a sequential programming language; hierarchical/concurrent state machine model (HCFM) and the state charts language; program state machine model(PSM);The role of an appropriate model and language.
3. Concurrent process models: concurrent processes: process create and terminate ,process suspend and resume, Process join; Communication among processes: shared memory, Message passing; synchronization among processes: Condition variables, monitors. Interrupts: interrupt Basics; The Shared Data Problem; interrupt latency
4. Survey of Software Architecture: Round Robin, Round Robin with interrupts, Function queue scheduling architecture, Real time operating system architecture, selecting architecture. Introduction to RTOS: Tasks and task states, tasks and Data, semaphores and shared data.
5. Operating systems services: Message queues, mailboxes, and pipes; Timer functions; Events; memory management, Interrupt routines in an RTOS environment. Basic design using an RTOS; Overview, principles, an example, encapsulating semaphores and queues, Hard Real-time scheduling considerations, saving power.
6. Embedded software development tools: Host and target machines; Linker/locator for Embedded software, getting embedded software into the target system. Debugging Techniques: Testing on host machine, instruction set simulators, macros and tools.
7. An example system: what the program does, environment in which the program operates.

Text Books :

1. **Embedded system design : A unified Hardware/software introduction** – Frank Vahid, Tony Givargis, John Wiley and Sons, Inc. 2002 (Articles : 2.4, 2.5, 2.6; 4.2, 8.3 to 8.13)
2. **An Embedded software Primer** – David E. Simon; Pearson Education, 1999. (Chapters: 4, 5, 6, 7, 8, 9, 10 and 11)

Reference books:

1. **Embedded C**: Michael J. Pont, Pearson Education (2002)
2. **Real-Time systems and programming languages** : Alan Burns and Andy Wellings, Addison Wesley-Longman (1997)

3. **Real Time programming : A guide to 32 bit embedded development**, Grehan, Moore and Cyliax, Addison-Wesley-longman.

II Semester

Formal Models in Computer Science

Subject Code : 12SCS21

IA Marks : 50

No of Lecture Hrs/Week : 4

Exam hours : 3

Total No of Lecture Hours : 52

Exam Marks : 100

1. Propositional Logic

Declarative sentences, Natural deduction, Propositional logic as a formal language, Semantics of propositional logic, Normal forms.

2. Predicate Logic

The need for a richer language, Predicate logic as a formal language, Proof theory of predicate logic, Semantics of predicate logic, Undecidability of predicate logic, Micromodels of software.

3. Verification by Model Checking

Motivation for verification, Linear-time temporal logic, Model checking, Branching-time logic, CTL* and the expressive powers of LTL and CTL.

4. Program Verification

Need for specifying and verifying code, A framework for software verification, Proof calculus for partial correctness and total correctness, Programming by contract.

5. Introduction to Z: Basic concepts; Z notation in Propositional logic and Predicate logic.

Laboratory Work:

1. Design, develop and run a program in ALLOY (or in any equivalent system) to model a Software Package Dependency System. Make suitable assumptions regarding the system. The model should allow checking to see if prerequisites in the form of libraries or other packages are present for all components in the system

2. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the Mutual Exclusion problem.

3. Design, develop and run a program in NuSMV (or in any equivalent system) to model and simulate the Alternate Bit Protocol.

4. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the planning problem of Ferry Man.

5. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the Dining Philosophers Problem.

Text Books:

1. Michael Huth and Mark Ryan: Logic in Computer Science, 2nd Edition, Cambridge University Press, 2004.
2. Jim Woodcock , Jim Davies: Using Z Specification, Refinement and Proof, Prentice Hall, 1996.

(Online Edition: <http://www.usingz.com/text/online/>)

Advanced Algorithms

Subject Code : 12SCS22
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

2. Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

3. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

4. Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

5. String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

6. Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

Laboratory Work:

1. Design, develop, and run a program in any language to implement the Bellman-Ford algorithm and determine its performance.
2. Design, develop, and run a program in any language to implement Johnson's algorithm and determine its performance.
3. Design, develop, and run a program in any language to implement a Monte Carlo algorithm to test the primality of a given integer and determine its performance.
4. Design, develop, and run a program in any language to solve the string matching problem using naïve approach and the KMP algorithm and compare their performances.
5. Design, develop, and run a program in any language to solve modular linear equations.
6. Design, develop, and run a program in any language to implement the FFT algorithm efficiently.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Advances in Computer Architecture

Subject Code : 12SCS23

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction and Review of Fundamentals of Computer Design: Introduction; Classes computers; Defining computer architecture; Trends in Technology; Trends in power in Integrated Circuits; Trends in cost; Dependability, Measuring, reporting and summarizing Performance; Quantitative Principles of computer design; Performance and Price-Performance; Fallacies and pitfalls; Case studies.

2. Some topics in Pipelining, Instruction –Level Parallelism, Its Exploitation and Limits on ILP: Introduction to pipelining, ILP; Crosscutting issues, fallacies, and pitfalls with respect to pipelining; Basic concepts and challenges of ILP; Case study of Pentium 4, Fallacies and pitfalls. Introduction to limits in ILP; Performance and efficiency in advanced multiple-issue processors.

3. Memory Hierarchy Design, Storage Systems: Review of basic concepts; Crosscutting issues in the design of memory hierarchies; Case study of AMD Opteron memory hierarchy; Fallacies and pitfalls in the design of memory hierarchies. Introduction to Storage Systems; Advanced topics in disk storage; Definition and examples of real faults and failures; I/O performance, reliability measures, and benchmarks; Queuing theory; Crosscutting issues; Designing and evaluating an I/O system – The Internet archive cluster; Case study of NetAA FAS6000 filer; Fallacies and pitfalls.

4. Hardware and Software for VLIW and EPIC

Introduction: Exploiting Instruction-Level Parallelism Statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor, Concluding Remarks.

5. Large-Scale Multiprocessors and Scientific Applications

Introduction, Interprocessor Communication: The Critical Performance Issue, Characteristics of Scientific Applications, Synchronization: Scaling Up, Performance of Scientific Applications on Shared-Memory Multiprocessors, Performance Measurement of Parallel Processors with Scientific Applications, Implementing Cache Coherence, The Custom Cluster Approach: Blue Gene/L, Concluding Remarks.

6. Computer Arithmetic

Introduction, Basic Techniques of Integer Arithmetic, Floating Point, Floating-Point Multiplication, Floating-Point Addition, Division and Remainder, More on Floating-Point Arithmetic, Speeding Up Integer Addition, Speeding Up Integer Multiplication and Division, Fallacies and Pitfalls.

Text Book:

1. Hennessey and Patterson: “Computer Architecture A Quantitative Approach”, 4th Edition, Elsevier, 2007.

Reference Books:

1. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, 2nd Edition, Tata McGraw Hill, 2010.

Cloud Computing

Subject Code : 12SCS24
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

- 1. Introduction :** Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
- 2. Cloud models :** Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public versus private clouds, cloud infrastructure self service.
- 3. Cloud at a service :** Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand.
- 4. Cloud solutions :** Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.
- 5. Cloud offerings :** Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud.
- 6. Cloud management :** Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.
- 7. Cloud virtualization technology :** Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center.
- 8. Cloud and SOA :** SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

TEXT BOOKS:

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011.

Reference Books

1. Michael Miller, Cloud Computing: Web based applications that change the way you work and collaborate online, Que publishing , August 2009
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On Demand computing applications and data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

Subject Code : 12SCS251
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework.

2. Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-

T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards.

3. Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.

4. Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.

5. Network Layer: Introduction, QoS in Network Multimedia Systems.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India , 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.

2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

3. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Volume 1-Media Coding and Content Processing, 2nd Edition, Pearson, 2003.

4. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

Artificial Intelligence and Agent Technology

Subject Code: 12SCS252

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. **Artificial Intelligence:** What is AI., The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, **Intelligent Agents**, Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The structure of Agents.
2. **Solving problems by searching:** Problem-solving Agents, Example problems, Searching for solutions, Uninformed Search Strategies, Avoiding Repeated States, Searching with Partial Information, **Constraint Satisfaction Problems:** Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for Constraint Satisfaction Problems, The Structure of Problems.
3. **Logical Agents:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic , Reasoning Patterns in Propositional Logic Resolution, Effective propositional inference, Agents Based on Propositional Logic, First-Order Logic, Representative Revisited, Syntax and semantics of First-Order Logic, Using First-order Logic, Knowledge Engineering in First-Order Logic.
4. **Uncertainty:** Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Interface using full joint distributions, Independence, Bayes Rule and its use, The Wumpus World Revisited, **Probabilistic Reasoning**, Representing Knowledge in an Uncertain Domain, The semantics of Bayesian Networks, Efficient Representation of conditional distributions, Exact inference in Bayesian networks, Approximate inference in Bayesian Networks, Extending Probability to First-Order representations, Other Approaches to uncertain reasoning.
5. **Learning from Observations:** Forms of Learning, Inductive Learning, Learning Decision Trees, Ensemble Learning, Why Learning Works: computational Learning Theory, Statistical Learning Methods, **Statistical Learning:** Learning with complete data, Learning with Hidden Variables, Instance based Learning, Neural Networks, Kernel Machines, Case Study: Handwritten Digit Recognition, **Philosophical Foundations:** Weak AI, Strong AI, The Ethics and Risks of Developing Artificial Intelligence.

Text Book:

1. Stuart Russel, Peter Norvig: “Artificial Intelligence A Modern Approach”, 2nd Edition, Pearson Education, 2003.

Reference Books:

1. Elaine Rich, Kevin Knight: “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2009.
2. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, 1980

PROTOCOLS ENGINEERING

Subject Code: 12SCS253

Hours/Week : 04

Total Hours : 52

I.A. Marks : 50

Exam Hours: 03

Exam Marks: 100

1. Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases
2. Error Control, Flow Control: Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance
3. Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.
4. Protocol Specification: Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.
5. Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP Multi Protocol Label Switching SDL components.
6. Protocol Verification / Validation: Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol Validation: ABP Validation.
7. Protocol Conformance and Performance Testing: Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing

Multimedia Systems, quality of service test architecture(QoS), Performance Test methods, SDL Based Performance Testing of TCP, OSPF, Interoperability testing, Scalability testing protocol synthesis problem

8. Protocol Synthesis and Implementation: Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis, Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS.

TEXT BOOKS:

1. Pallapa Venkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.

REFERENCE BOOKS:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

Semester 3

Information Security

Subject Code : 12SCS31
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Information Security: Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.
2. Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.
3. Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections. Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.
4. Information Security maintenance: Introduction; Security Management Models; The Maintenance Model.
5. Introduction to Network Security: Attacks, Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs; Wireless network security.
6. Cryptography: Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.
7. Authentication Applications: Kerberos, X.509 Directory Authentication Service.
8. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.
9. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.
10. Web Security: Web security requirements, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET).
11. Software: Introduction; Software flaws; Malware; Software-based attacks; Digital Rights Management;

TEXT BOOKS:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.
2. William Stallings: Network Security Essentials Applications and Standards, Person, 2000.
3. Deven N. Shah: Information Security – Principles and Practice, Wiley India, 2009.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Cryptography and Network Security, Tata McGraw-Hill, 2007.

Wireless and Cellular Networks

Subject Code : 12SCS321
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems.
2. Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)
3. The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference.
4. Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.
5. Modulation Techniques for Mobile Radio: Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).
6. Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols,

Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems.

7. Wireless Networking: Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

TEXT BOOKS:

1. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2nd Edition, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. William C Y Lee: Mobile Communications Engineering Theory and Applications, 2nd Edition, McGraw Hill, 1998.

2. William Stallings: Wireless Communications and Networks, Pearson Education Asia, 2002.

Storage Area Networks

Subject Code : 12SCS322

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access.

2. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

3. I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre

Channel Protocol Stack; Fibre Channel SAN; IP Storage.

4. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

5. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

6. Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

7. SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

8. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

9. Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2007.

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – A n Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.

2. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2003.

3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Advances in Pattern Classification

Subject Code : 12SCS323

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Polynomial Curve Fitting, Probability Theory, Probability Distributions, Model Selection, Decision Theory, Information Theory

2. Linear Models for Regression: Linear Basis Function Models, The Bias Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison, The Evidence Approximation, Limitations of Fixed Basis Functions

3. Linear Models for Classification: Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, The Laplace Approximation, Bayesian Logistic Regression

4. Kernel Methods: Dual Representations, Constructing Kernels, RBF Networks, Gaussian Processes, Sparse Kernel Machines: SVMs, Multiclass SVMs, Relevance Vector Machines

5. Unsupervised Learning: Introduction, Association Rules, Cluster Analysis, Self-Organizing Maps, Principal Components, Curves and Surfaces, Non-negative Matrix Factorization, Independent Component Analysis and Exploratory Projection Pursuit, Multidimensional Scaling, Nonlinear Dimension Reduction and Local Multidimensional Scaling, The Google PageRank Algorithm

6. Mixture Models and EM: Mixtures of Gaussians, An alternative view of EM, The EM Algorithm in general.

7. High-Dimensional Problems: The Curse of Dimensionality, Diagonal Linear Discriminant Analysis and Nearest Shrunken Centroids, Linear Classifiers with Quadratic Regularization, Linear Classifiers with L1 Regularization, Classification when Features are Unavailable, High-Dimensional Regression: Supervised Principal Components, Feature Assessment and the Multiple-Testing Problem.

Text Books:

1. Christopher M Bishop: Pattern Recognition and Machine Learning, Springer, 2006.
2. Trevor Hastie, Robert Tibshirani, and Jerome Friedman: The Elements of Statistical Learning, Springer, 2008.

Reference Books:

1. R. O. Duda, P. E. Hart, and D. G. Stork: Pattern Classification by 2nd edition, Wiley –Interscience , 2001.
2. Sergios Theodoridis and Konstantinos Koutroumbas: Pattern Recognition, 2nd Edition, Elsevier, 2003.

MULTI-CORE ARCHITECTURE & PROGRAMMING

Subject Code : 12SCS324
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Multi-core Architecture

Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

2. System Overview of Threading

Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

3. Fundamental Concepts of Parallel Programming

Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

4. Threading and Parallel Programming Constructs

Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.

5. Threading APIs

Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

6. OpenMP: A Portable Solution for Threading

Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

7. Solutions to Common Parallel Programming Problems

Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Analysis of Computer Networks

Subject Code : 12SCS331
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; The importance of quantitative modeling in the Engineering of Telecommunication Networks.

2. Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

3. Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

3. Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

4. Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; Sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999.

Data Mining & Warehousing

Subject Code : 12SCS332

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. INTRODUCTION:

What is a Data Warehouse?, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, From Data warehousing to Data Mining, Data Mining Functionalities, Data cleaning, Data Integration and Transformation, Data Reduction.

12 HOURS.

2. DATA MINING PRIMITIVES, LANGUAGES AND SYSTEM ARCHITECTURES: Data Mining primitives, Presentation and Visualization of Discovered patterns, A Data Mining Query Language.

07 HOURS.

3 MINING ASSOCIATION RULES IN LARGE DATA BASES: Association Rule Mining Single – Dimensional Boolean Association Rules From Transactional Databases, Mining Multilevel Association Rules from Transactional Databases. 07 HOURS.

4 CLASSIFICATION AND PREDICTION: Issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification, Classification by back propagation, Classification Based on the concepts from association rule mining. Other classification methods, prediction.

08 HOURS.

5 CLUSTER ANALYSIS: What is Cluster Analysis? Types of data in cluster Analysis: a Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Model-Based Clustering Methods: Statistical Approach, Neural Network Approach Outliner Analysis.

12 HOURS.

6 APPLICATIONS AND TRENDS IN DATA MINING: Data mining application, Data mining system Products research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Trends in Data Mining. 06 HOURS.

Text Books:

1. Jiawei Michelin Kamber, "Data Mining Concepts and Techniques", Morgan Kauf Mann Publishers.

Advances in VLSI Design and Algorithms

Subject Code : 12SCS333
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing;

Integrated Circuit Design Techniques; IP-Based Design.

2. Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

3. Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

4. Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

5. Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

6. Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

TEXT BOOKS:

1. Wayne Wolf: "Modern VLSI design", 3rd edition, Pearson Education, 2007.
2. Sabih H Gerez: "Algorithms for VLSI Design Automation", Wiley India, 2007,

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCS11	Advances in Operating Systems	4	--	03	50	100	150	4
14SCS12	Cloud Computing	4	2 *	03	50	100	150	4
14SCS13	Advances in Data Base Management System	4	2 *	03	50	100	150	4
14SCS14	Multi Core Architecture and Programming	4	2	03	50	100	150	4
14SCS15x	Elective – I	4	2	03	50	100	150	4
14SCS16	Advances in Operating Systems Laboratory	0	3	03	25	50	75	2
14SCS17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I:

14SCS152 Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS21	Managing Big Data	4	2 *	03	50	100	150	4
14SCS22	Advances in Computer Networks	4	2 *	03	50	100	150	4
14SCS23	Advanced Algorithms	4	--	03	50	100	150	4
14SCS24	Artificial Intelligence and Agent Technology	4	2	03	50	100	150	44
14SCS25x	Elective – II	4	2	03	50	100	150	4
14SCS26	Advanced Algorithms Laboratory	0	3	03	25	50	75	2
14SCS27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCS252 Information and Network Security

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork		I.A.	Exam		
14SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *	--	--	--	25	--	25	1
14SCS32	Report on Internship **	--	--	--	--	75	75	15
14SCS33	Evaluation and Viva-voce	--	--	3	--	50	50	4
Total		--	--	3	25	125	150	20

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching					Total Marks	CREDITS
		hours/week		Duration of Exam in Hours	Marks for			
		Lecture	Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS41	Machine Learning Techniques	4	2 *	03	50	100	150	4
14SCS42x	Elective-III	4	2	03	50	100	150	4
14SCS43	Evaluation of Project Phase-II	0	--	0	25	--	25	1
14SCS44	Evaluation of Project Phase-III	0	--	0	25	--	25	1
14SCS45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	200	18
Total		08	07	09	150	400	550	28
Grand Total (I to IV Sem.)			Marks: 2400 ;		Credits : 94			

Elective – III

14SCS423 Agile Technologies

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1).Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase = III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 (50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce).

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Semester: I

Year: 2014-2015

Course Title: Advances In Operating Systems	Course Code: 14SCS11
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating Systems.

TOPICS:

MODULE I

Operating System Overview, Process description & control

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management.

10 Hours

Module II

Threads, SMP, and Microkernel, Virtual Memory.

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Vista Thread and SMP Management, Solaris Thread and SMP Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.

10 Hours

Module III

Multiprocessor and Real-Time Scheduling

Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

10 Hours

Module IV

Embedded Operating Systems

Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

10 Hours

MODULEV

Kernel Organization

Using Kernel Services, Daemons, Starting the Kernel , Control in the Machine , Modules and Device Management, MODULEOrganization, MODULEInstallation and Removal, Process and Resource Management, Running Process

Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management.

The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager , Kernel local procedure calls and IPC, The native API, subsystems.

10 Hours

Course Outcomes:

The students should be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Semester: I

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCS12
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.

Topics:

Module I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

Module II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

Module III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

Module IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

Module V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment (**Eg; Amazon cloud**) and **VM ware for resource virtualization.**

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a *web-hosting application service*, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for

a. Strassen's Matrix Multiplication for a huge matrix.

b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on

the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor

with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must re compute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:

The students should be able to:

- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Course Title: Advances in Database Management Systems	Course Code: 14SCS13
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented database
- To understand the basic concepts, principles of intelligent databases.
- To understand the advanced topics of data warehousing and mining .
- To learn emerging and advanced data models
- To acquire inquisitive attitude towards research topics in databases.

Topics:**MODULE I**

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II

Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition language, ODL, Object Query Language, OQL, Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of: SQL, Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV

Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

10 Hours

LABORATORY WORK:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.
2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.
3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:
 - a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
 - b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.
4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Course Title: Multi-Core Architecture and Programming	Course Code: 14SCS14
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:**MODULE I**

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **10 Hours**

Module II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours**MODULE III**

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours**MODULE IV**

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared

Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

Course Outcomes:

The students should be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Semester: I

Year: 2014-2015

Course Title: Advances in Digital Image Processing	Course Code: 14SCS151
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:

MODULE I

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

10 Hours

MODULE II

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

10 Hours

MODULE III

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

10 Hours

MODULE IV

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **Wavelets and Multiresolution Processing:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image Compression:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

10 Hours

MODULE V:

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

10 Hours

Course Outcomes:

The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image
- Apply algorithms in practical applications.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005

REFERENCES:

- 1.A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
- 2.Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Semester: I

Year: 2014-2015

Course Title: Advances in Storage Area Networks	Course Code: 14SCS152
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management,

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept,
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Downloaded from A-ZShiksha.com

Course Title: Embedded Computing Systems	Course Code: 14SCS153
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COUR
SE**OBJECTIVES**

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:**MODULE I**

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

7 Hours**MODULE II**

Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours**MODULE III**

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours**MODULE IV**

Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

10 Hours**MODULE V**

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. **Introduction to embedded**

software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:

The students should be able to:

- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:

1. **Raj Kamal**, “Embedded Systems: Architecture, Programming, and Design” 2nd edition , Tata McGraw hill-2013

Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

2. **Marilyn Wolf** ,“Computer as Components, Principles of Embedded Computing System Design” 3rd edition , Elsevier-2014 .

Course Title: Advances in Computer Graphics	Course Code: 14SCS154
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:**MODULE I**

Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bazier Surfaces B-Spline Curves, B-Spline Surfaces, Beta- Splines, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and rfaces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours**MODULE II**

Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions.

10 Hours**MODULE III**

Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping, OpenGL Illumination and surface-rendering functions, openGL texture functions.

10 Hours**MODULE IV**

Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications. Raster methods for computer animation, Design of animations sequences, Traditional animation techniques,

General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V

Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using OpenGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:

The students are able to :

- Represent and implement images and objects using 3D representation and OpenGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:

1. Computer Graphics with OpenGL-Hearn Baker 4rd edition, Pearson publication.2010 (Chapter 8,9,10.12.13.14,15)
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013

Reference Books:

1. Edward Angel: Interactive Computer graphics a top-down approach with OpenGL, Addison Wesley, 6th edition 2012
2. Advanced graphics programming using OpenGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005

Semester: I

Year: 2014-2015

Course Title: Advances in Operating Systems Laboratory	Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/ any equivalent language or tool with suitable platform.

1. Design and Develop a shell that should support at least 20 commands.
2. Design and develop a program to implement lazy buddy system algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
5. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:

- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Course Title: Managing Big Data	Course Code: 14SCS21
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:**MODULE I**

UNDERSTANDING BIG DATA 10 Hours What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

MODULE II

NOSQL DATA MANAGEMENT 10 Hours Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – version – MapReduce – partitioning and combining – composing map-reduce calculations

MODULE III**BASICS OF HADOOP****10 Hours**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

MODULE IV

MAPREDUCE APPLICATIONS 10 Hours MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V

HADOOP RELATED TOOLS 10 Hours Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LAB Experiments**Exercise 1 --- HDFS**

Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the `hadoop fs` command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file `foo.txt` from local disk to the user's directory in HDFS
3. Get a directory listing of the user's home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file `user/fred/bar.txt`
6. Move that file to the local disk, named as `baz.txt`
7. Create a directory called `input` under the user's home directory
8. Delete the directory `input` and all its contents
9. Verify the copy by listing the directory contents in HDFS:

Exercise 2 --- MapReduce

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

Exercise 3 --- MapReduce (Programs)

Using movie lens data

1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

Exercise4 – Extract facts using Hive

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The `moveapp_log_json` table contains an activity column. Activity states are as follows:

1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE

```
hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json (
custId INT,
movieId INT,
genreId INT,
time STRING,
recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json
```

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.
3. Load the results of the previous two queries into a staging table. First, create the staging table:
4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce

tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.
2. Group the log sample by movie and dump the resulting bag.

3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

Course Outcomes:

The students should be able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

References:

1. **Uyless Black** "Computer Networks, Protocols , Standards and Interfaces" 2nd Edition - PHI
2. **Behrouz A Forouzan** "TCP/IP Protocol Suite" 4th Edition – Tata McGraw-Hill

Course Title: Advanced Algorithms	Course Code: 14SCS23
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:**MODULE I**

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours**MODULE II**

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours**MODULE III**

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours**MODULE IV**

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours**MODULE V**

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Semester: II

Year: 2014-2015

Course Title: Artificial Intelligence and Agent Technology	Course Code: 14SCS24
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

TOPICS:

MODULE I

What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.

Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. **Intelligent Agents:** Agents and Environments, The nature of environments, The structure of agents.

Text Book 1: Chapter 1 & 2

Text Book 2: Chapter 2

10 Hours

MODULE II

Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.

Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6

10 Hours

MODULE III

Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.

Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited.

Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13

10Hours

MODULE IV

Weak Slot-and-filter structures: Semantic Nets, Frames.

Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary

Text Book 1: Chapter 9 & 10 Text Book 2: Chapter 5

10 Hours

MODULE V

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Text Book 2: Chapter 18 & 20

10 Hours

COURSE OUTCOMES:

The students are able to:

- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

Text Books.

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books:

3. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

Semester: II

Year: 2014-2015

Course Title: Web Services	Course Code: 14SCS251
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

TOPICS:

MODULE I

Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **10 Hours**

MODULE II

Web Services: Web Services Technologies, Web Services Architecture. **10 Hours**

MODULE III

Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards. **10 Hours**

MODULE IV

Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **10 Hours**

MODULE V

Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example. **10 Hours**

Course Outcomes:

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Course Title: Information And Network Security	Course Code: 14SCS252
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:**MODULE I****Classical Encryption Techniques**

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours**MODULE II**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, Public-key cryptosystems. Applications for public-key cryptosystems, Requirements for public-key cryptosystems, public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours**MODULE III**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours**MODULE IV**

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, . **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic

Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

10 Hours

Course Outcomes:

The students be able to

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

References

1. V k Pachghare: Cryptography and Information Security, PHE ,2013.

Semester: II

Year: 2014-2015

Course Title : Pattern Recognition	Course Code: 14SCS253
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

10 Hours

MODULE II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

10 Hours

MODULE III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

10 Hours

MODULE IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

10 Hours

MODULE V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples.

10 Hours

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Develop and analyze decision trees.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

References

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

Course Title: Optical Networks	Course Code: 14SCS254
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors -
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:**MODULE I**

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours**MODULE II****WDM Network Elements**

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours**MODULE III****Control and Management**

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours**MODULE IV****Basic Concepts, Protection in SONET/SDH:**

Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1: N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design:

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES:

The students will be able to:

- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Semester: II

Year: 2014-2015

Course Title: Advanced Algorithms Laboratory	Course Code: 14SCS26
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/language by adapting exception handling technique wherever it is suitable.

1. Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2. Design, develop, and write a program to implement a Monte Carlo algorithm to test the **primality** of a given integer and determine its performance.
3. Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4. Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.
5. Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes:

Upon completion of the course, the students will be able to

- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Course Title: Machine Learning Techniques	Course Code: 14SCS41
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

TOPICS:**MODULE I****INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **10 Hrs**

MODULE II**NEURAL NETWORKS AND GENETIC ALGORITHMS**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **10 Hrs**

MODULE III**BAYESIAN AND COMPUTATIONAL LEARNING**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **10 Hrs**

MODULE IV**INSTANT BASED LEARNING AND LEARNING SET OF RULES**

K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **10 Hrs**

MODULE V**ANALYTICAL LEARNING AND REINFORCED LEARNING**

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **10 Hrs**

LABORATORY WORK

(The following tasks can be implemented in a language of your choice or any tools available)

- 1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
- 2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.

- 3) Implement the ID3 algorithm for learning Boolean-valued functions for classifying the training examples by searching through the space of a Decision Tree.
- 4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
- 5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES:

2. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Course Title: Computer Vision	Course Code: 14SCS421
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:**MODULE I**

CAMERAS: Pinhole Cameras, **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

10 Hours**MODULE II**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

10 Hours**MODULE III**

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

10 Hours**MODULE IV**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

10 Hours**MODULE V**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, **Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into

Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model- Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **10 Hours**

Course Outcomes:

Upon completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

4. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Course Title: Business Intelligence And Its Applications	Course Code: 14SCS422
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:**MODULE I**

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

10 Hours**MODULE II**

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours**MODULE III**

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours**MODULE IV**

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

10 Hours**MODULE V**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework

- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

3. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
4. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
5. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

Course Title: Agile Technologies	Course Code: 14SCS423
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **10 Hours**

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **10 Hours**

MODULE III

Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

10 Hours

MODULE IV

Mastering Agility

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence** :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

COURSE OUTCOMES

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
- 2., "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

Course Title: Wireless Networks And Mobile Computing	Course Code: 14SCS424
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To understand CDMA, GSM, Mobile IP, Wimax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Wireless Networks :** Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

10 Hours

MODULE II

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

10 Hours

MODULE III

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours

MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:

The student should be able to:

- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDP let model and security concerns

TEXT BOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

I Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam	
12SCS11	Computer Networks	04	02#	03	50	100	150
12SCS12	Advances in Operating Systems	04	02*	03	50	100	150
12SCS13	Advances in Database Management Systems	04	02*	03	50	100	150
12SCS14	Computer Systems Performance Analysis	04	02#	03	50	100	150
12SCS15x	Elective – I	04	02	03	50	100	150
12SCS16	Seminar	--	03	--	50	--	50
Total		20	13	15	300	500	800

Elective I

12SCS154 Embedded Systems

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

II Semester

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam	
12SCS21	Formal Models in Computer Science	04	2*	03	50	100	150
12SCS22	Advanced Algorithms	04	2*	03	50	100	150
12SCS23	Advances in Computer Architecture	04	2#	03	50	100	150
12SCS24	Cloud Computing	04	2#	03	50	100	150
12SCS25x	Elective – II	04	2	03	50	100	150
	**Project Phase-I(6 Week Duration)				--		--
12SCS26	Seminar		03		50	--	50
Total		20	13	15	300	500	800

Elective – II

12SCS253 Protocols Engineering

**** Between the II Semester and III Semester after availing a vocation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

III Semester

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks
		Lecture	Field Work / Assignment / Tutorials		I.A.	Exam	
12SCS31	Information Security	4	--	3	50	100	150
12SCS32x	Elective-III	4	2	3	50	100	150
12SCS33x	Elective-IV	4	2	3	50	100	150
12SCS34	Project Phase-II		§				
12SCS35	Evaluation of Project Phase – I	–	3	–	50	–	50
Total		12	07	09	200	300	500

Elective – III

12SCS322 Advances in Storage Area Networks

Elective – IV

12SCS331 Analysis of Computer Networks

§ 3 Days Course work and 3 days for Project work

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. COMPUTER SCIENCE and ENGINEERING

IV Semester

Course Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks
		Lecture	Practical / Field Work		I.A.	Exam	
12SCS41	Evaluation of Project Phase – II	-	-	-	50	-	50
12SCS42	Evaluation of Project work – III	-	-	-	50	-	50
12SCS43	Project work evaluation and Viva-voce	-	-	3	-	100+100	200
	Total	-	-	03	100	200	300
Grand Total (I to IV Sem.) : 2400							

Note: Project work shall be continuously evaluated for phase I, phase II and after completion of the project.

Note:

- * Lab Classes for any two core subjects are compulsory (practical will be evaluated for 20 marks and internal assessment for 30 marks. Lab journals should be maintained).
 - # For the remaining two core subjects, it can be field work, assignment, tutorials.
- 1) Project Phase – I : 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation. Evaluation of the same shall be taken up during beginning of III Semester. Total Marks shall be 50. Colleges have to send the synopsis after Phase – I.
 - 2) Project Phase – II : 16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 50.
 - 3) Project Phase – III : 24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. Total Marks shall be 50. At the end of the Semester Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be $50 + 50 + 100 = 200$ (50 marks for guide, 50 marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The Marks of Project Phase – I shall be sent to the University along with III Semester I.A. Marks of other subjects.
 - The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (out of two external examiners at least one should be present).

M. Tech in Computer Science and Engineering

I SEMESTER

COMPUTER NETWORKS

Subject Code: 12SCS11

Hours/Week : 04

Total Hours : 52

I.A. Marks : 50

Exam Hours: 03

Exam Marks: 100

1. Review of Basic Concepts: Building a Network; Requirements- Connectivity, Cost-Effective Resource Sharing, Support for Common Services; Network Architecture- Layering and Protocols, OSI Architecture, Internet Architecture; Performance- Bandwidth and Latency, Delay \times Bandwidth Product, High-Speed Networks.

2. Direct link networks: Hardware Building Blocks-nodes, links; error Detection- Two-Dimensional Parity, Internet checksum Algorithm, cyclic Redundancy Check; reliable Transmission- Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Rings (802.5, FDDI) –Token Ring Media Access Control, Token Ring Maintenance, FDDI.

3. Packet Switching: Switching and forwarding – Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches – Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges; cell switching (ATM) – Cells, Segmentation and Reassembly, Virtual Paths, Physical Layers for ATM.

4. Internetworking: Simple internetworking (IP) – What Is an Internetwork?, Service Model, Global Address, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels; Routing – Network as a Graph, distance Vector(RIP), Link State(OSPF), Metrics, Routing for Mobile Hosts, Global Internet – Subnetting, Classless Routing(CIDR), Interdomain Routing(BGP), Routing Areas, IP Version 6(IPv6).

5. End –to-End Protocols: Simple demultiplexer (UDP); Reliable byte stream (TCP) – End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Alternative Design Choices.

6. Congestion Control and Resource Allocation: Issues in resource allocation – Network Model, Taxonomy, Evaluation Criteria; Queuing discipline – FIFO, Fair Queuing; TCP Congestion Control – Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion-Avoidance mechanisms – DECBIT, Random Early Detection (RED), Source-Based Congestion Control.

7. Applications: Traditional applications – Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Name Service (DNS), Network management (SNMP); Web services – Custom APPLICATION Protocols (WSDL, SOAP), A Generic application Protocol (REST).

Laboratory Work:

Using any Protocol Analyzer like Ethereal, perform the following experiments:

1. Capture the packets that are transmitted after clicking on the URL of the web site of your college. Analyze the packets at the highest level and prepare a brief report of your analysis.
2. Analyze the data captured above at lower levels and demonstrate the layering of the protocols.
3. Capture the packets in the LAN, & filter for a unique subscriber
4. Capture the ARP packets and find the MAC addresses in the LAN in your laboratory.

Using either NS228/OPNET or any other suitable simulator, perform the following experiments:

1. Simulate an Ethernet LAN using 10 node , change error rate and data rate , and compare throughput
2. Simulate a three nodes point – to – point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
3. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
4. Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Implement the following in C/C++:

1. Write a program for distance vector algorithm to find suitable path for transmission.
2. Write a program for error detecting code using CRC-CCITT (16-bit)
3. Write a program for congestion control using leaky bucket algorithm.

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

Advances in Operating Systems

Subject Code : 12SCS12

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction, Review Operating Systems Strategies: User' perspectives, technologies and examples of Batch Systems, Timesharing Systems, Personal computer systems, Embedded systems, and small communicating computers; The genesis of modern operating systems.

2. Using the Operating Systems The programmer's abstract machine; Resources; Processes and threads; Writing concurrent programs.

3. Operating Systems Organization Basic functions; General implementation considerations; Contemporary OS kernels.

4. Design Strategies Design considerations; Monolithic kernels; Modular organization; Microkernel; Layered organizations; Operating Systems for distributed system.

5. Real World Examples Linux, Windows NT/2000/XP: Process descriptors, Thread descriptors, Thread scheduling. Linux, Windows NT/2000/XP: Kernel

6. Distributed Systems: Networking; The Need for a Protocol Architecture; The TCP/IP Sockets; Linux Networking; Client/Server Computing; Distributed Message Passing; Remote Procedure Calls; Clusters; Windows Vista Cluster Server; Linux Clusters; Distributed Process Management; Process Migration; Distributed Global States; Distributed Mutual Exclusion; Distributed Deadlock.

Laboratory Work: (The following programs can be executed on any available and suitable platform)

1. Design, develop and execute a program using any thread library to create the number of threads specified by the user; each thread independently generates a random integer as an upper limit, and then computes and prints the number of primes less than or equal to that upper limit along with that upper limit.

2. Rewrite above program such that the processes instead of threads are created and the number of child processes created is fixed as two. The program should make use of kernel timer to measure and print the real time, processor time, user space time and kernel space time for each process.

3. Design, develop and implement a process with a producer thread and a consumer thread which make use of a bounded buffer (size can be prefixed at a suitable value) for communication. Use any suitable synchronization construct.

4. Design, develop, and execute a program to solve a system of n linear equations using Successive Over-relaxation method and n processes which use Shared Memory API. 5. Design, develop, and execute a program to demonstrate the use of RPC.

Text Books:

1. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2004.

2. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2008.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008

2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.

3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007.

Advances in Database Management Systems

Subject Code : 12SCS13
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

2. Object and Object-Relational Databases: Overview of Object-Oriented Concepts – Objects, Encapsulation, Type and class hierarchies, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

3. Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts.

4. Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

5. Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support; View materialization; Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

6. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

Laboratory Work:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.

2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:

a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.

b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2007.

2. Raghuram Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

2. Connolly and Begg: Database Systems, 4th Edition, Pearson Publications, 2005.

Computer Systems Performance Analysis

Subject Code : 12SCS14

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

2. Workloads, Workload Selection and Characterization: Types of Work loads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

3. Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid

monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

4. Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs.

5. Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

6. Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2007.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.

2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Advances in Digital Image Processing

Subject Code : 12SCS151

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.

2. Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.
3. Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
4. Image Enhancement in the Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.
5. Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.
6. Color Fundamentals: Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.
7. Image Transformation: Discrete Cosine Transforms, Walsh Hadamard Transforms, Wavelet Transforms and Multiprocessing, Background, Multiresolution Expansions, Wavelet Transforms in one Dimension, Wavelet Transforms in Two Dimensions, Wavelet Packets, an overview of Second Generation Wavelet Transforms.
8. Image and Video Compression: Fundamentals, Image Compression Models, Lossless compression Methods: Huffman coding, run length coding, LZ coding, Arithmetic coding, Lossy Compression: Gray level Run length coding, Block truncation coding, vector quantization, Differential predictive coding, Transform coding , Hybrid coding, Video Compression Techniques – Motion compensation, Search for motion vectors, H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 .
9. Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.
10. Image Segmentation and Object Recognition: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005
2. Scott.E.Umbaugh: Computer Vision and Image Processing, Prentice Hall, 1997

REFERENCES:

1. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
2. Z. Li and M.S. Drew: Fundamentals of Multimedia, Pearson, 2004.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, TataMcGraw Hill, 2004.

Computer Graphics and Visualization

Subject Code : 12SCS152
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. Graphics Programming: The Sierpinski gasket; Programming two-dimensional applications.

2. The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

3. Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

4. Geometric Objects and Transformations: Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

5. Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Projections and shadows.

6. Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Computation of vectors; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

7. Curves and surfaces: Representation of curves and surfaces; Design criteria; Parametric cubic polynomial curves; Interpolation; Hermite curves and surfaces; Bezier curves and surfaces; Cubic B-Splines; General B-Splines; Rendering curves and surfaces; Curves and surfaces in OpenGL.

Text Book:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson, 2009.

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 2nd Edition, Pearson, 2004.

2. F.S. Hill,Jr.: "Computer Graphics Using OpenGL", 2nd Edition, Pearson, 2001.

3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-Wesley 1997.

OPTICAL NETWORKS

Subject Code : 12SCS153
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Client Layers of the Optical Layer

SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

2. WDM Network Elements

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.

3. Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. Configuration Management: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

4. Basic Concepts

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

5. WDM Network Design

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model, Maximum Load Dimensioning Models: Offline Light path Requests, Online RWA in Rings.

Text Book

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

Embedded Systems

Subject Code : 12SCS154
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Custom single-purpose processor design; RT level custom single-purpose processor design, optimizing custom single-purpose processors: Optimizing the original program, optimizing the FSM, Optimizing the data path, optimizing the FSM.
2. Timers, counters, and watchdog timers. State machine models: introduction; An introductory example, A basic state machine model: finite-state machines(FSM);finite-state machines with data path model (FSMD);using state machines: Describing a system as a state machine, Comparing state machine and sequential program models, Capturing a state machine model in a sequential programming language; hierarchical/concurrent state machine model (HCFM) and the state charts language; program state machine model(PSM);The role of an appropriate model and language.
3. Concurrent process models: concurrent processes: process create and terminate ,process suspend and resume, Process join; Communication among processes: shared memory, Message passing; synchronization among processes: Condition variables, monitors. Interrupts: interrupt Basics; The Shared Data Problem; interrupt latency
4. Survey of Software Architecture: Round Robin, Round Robin with interrupts, Function queue scheduling architecture, Real time operating system architecture, selecting architecture. Introduction to RTOS: Tasks and task states, tasks and Data, semaphores and shared data.
5. Operating systems services: Message queues, mailboxes, and pipes; Timer functions; Events; memory management, Interrupt routines in an RTOS environment. Basic design using an RTOS; Overview, principles, an example, encapsulating semaphores and queues, Hard Real-time scheduling considerations, saving power.
6. Embedded software development tools: Host and target machines; Linker/locator for Embedded software, getting embedded software into the target system. Debugging Techniques: Testing on host machine, instruction set simulators, macros and tools.
7. An example system: what the program does, environment in which the program operates.

Text Books :

1. **Embedded system design : A unified Hardware/software introduction** – Frank Vahid, Tony Givargis, John Wiley and Sons, Inc. 2002 (Articles : 2.4, 2.5, 2.6; 4.2, 8.3 to 8.13)
2. **An Embedded software Primer** – David E. Simon; Pearson Education, 1999. (Chapters: 4, 5, 6, 7, 8, 9, 10 and 11)

Reference books:

1. **Embedded C**: Michael J. Pont, Pearson Education (2002)
2. **Real-Time systems and programming languages** : Alan Burns and Andy Wellings, Addison Wesley-Longman (1997)

3. **Real Time programming : A guide to 32 bit embedded development**, Grehan, Moore and Cyliax, Addison-Wesley-longman.

II Semester

Formal Models in Computer Science

Subject Code : 12SCS21

IA Marks : 50

No of Lecture Hrs/Week : 4

Exam hours : 3

Total No of Lecture Hours : 52

Exam Marks : 100

1. Propositional Logic

Declarative sentences, Natural deduction, Propositional logic as a formal language, Semantics of propositional logic, Normal forms.

2. Predicate Logic

The need for a richer language, Predicate logic as a formal language, Proof theory of predicate logic, Semantics of predicate logic, Undecidability of predicate logic, Micromodels of software.

3. Verification by Model Checking

Motivation for verification, Linear-time temporal logic, Model checking, Branching-time logic, CTL* and the expressive powers of LTL and CTL.

4. Program Verification

Need for specifying and verifying code, A framework for software verification, Proof calculus for partial correctness and total correctness, Programming by contract.

5. Introduction to Z: Basic concepts; Z notation in Propositional logic and Predicate logic.

Laboratory Work:

1. Design, develop and run a program in ALLOY (or in any equivalent system) to model a Software Package Dependency System. Make suitable assumptions regarding the system. The model should allow checking to see if prerequisites in the form of libraries or other packages are present for all components in the system

2. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the Mutual Exclusion problem.

3. Design, develop and run a program in NuSMV (or in any equivalent system) to model and simulate the Alternate Bit Protocol.

4. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the planning problem of Ferry Man.

5. Design, develop and run a program in NuSMV (or in any equivalent system) to model and solve the Dining Philosophers Problem.

Text Books:

1. Michael Huth and Mark Ryan: Logic in Computer Science, 2nd Edition, Cambridge University Press, 2004.
2. Jim Woodcock , Jim Davies: Using Z Specification, Refinement and Proof, Prentice Hall, 1996.

(Online Edition: <http://www.usingz.com/text/online/>)

Advanced Algorithms

Subject Code : 12SCS22
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

2. Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

3. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

4. Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

5. String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

6. Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

Laboratory Work:

1. Design, develop, and run a program in any language to implement the Bellman-Ford algorithm and determine its performance.
2. Design, develop, and run a program in any language to implement Johnson's algorithm and determine its performance.
3. Design, develop, and run a program in any language to implement a Monte Carlo algorithm to test the primality of a given integer and determine its performance.
4. Design, develop, and run a program in any language to solve the string matching problem using naïve approach and the KMP algorithm and compare their performances.
5. Design, develop, and run a program in any language to solve modular linear equations.
6. Design, develop, and run a program in any language to implement the FFT algorithm efficiently.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Advances in Computer Architecture

Subject Code : 12SCS23

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction and Review of Fundamentals of Computer Design: Introduction; Classes computers; Defining computer architecture; Trends in Technology; Trends in power in Integrated Circuits; Trends in cost; Dependability, Measuring, reporting and summarizing Performance; Quantitative Principles of computer design; Performance and Price-Performance; Fallacies and pitfalls; Case studies.

2. Some topics in Pipelining, Instruction –Level Parallelism, Its Exploitation and Limits on ILP: Introduction to pipelining, ILP; Crosscutting issues, fallacies, and pitfalls with respect to pipelining; Basic concepts and challenges of ILP; Case study of Pentium 4, Fallacies and pitfalls. Introduction to limits in ILP; Performance and efficiency in advanced multiple-issue processors.

3. Memory Hierarchy Design, Storage Systems: Review of basic concepts; Crosscutting issues in the design of memory hierarchies; Case study of AMD Opteron memory hierarchy; Fallacies and pitfalls in the design of memory hierarchies. Introduction to Storage Systems; Advanced topics in disk storage; Definition and examples of real faults and failures; I/O performance, reliability measures, and benchmarks; Queuing theory; Crosscutting issues; Designing and evaluating an I/O system – The Internet archive cluster; Case study of NetAA FAS6000 filer; Fallacies and pitfalls.

4. Hardware and Software for VLIW and EPIC

Introduction: Exploiting Instruction-Level Parallelism Statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor, Concluding Remarks.

5. Large-Scale Multiprocessors and Scientific Applications

Introduction, Interprocessor Communication: The Critical Performance Issue, Characteristics of Scientific Applications, Synchronization: Scaling Up, Performance of Scientific Applications on Shared-Memory Multiprocessors, Performance Measurement of Parallel Processors with Scientific Applications, Implementing Cache Coherence, The Custom Cluster Approach: Blue Gene/L, Concluding Remarks.

6. Computer Arithmetic

Introduction, Basic Techniques of Integer Arithmetic, Floating Point, Floating-Point Multiplication, Floating-Point Addition, Division and Remainder, More on Floating-Point Arithmetic, Speeding Up Integer Addition, Speeding Up Integer Multiplication and Division, Fallacies and Pitfalls.

Text Book:

1. Hennessey and Patterson: “Computer Architecture A Quantitative Approach”, 4th Edition, Elsevier, 2007.

Reference Books:

1. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, 2nd Edition, Tata McGraw Hill, 2010.

Cloud Computing

Subject Code : 12SCS24
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. **Introduction** : Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
2. **Cloud models** : Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public versus private clouds, cloud infrastructure self service.
3. **Cloud at a service** : Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service demand.
4. **Cloud solutions** : Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.
5. **Cloud offerings** : Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud.
6. **Cloud management** : Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.
7. **Cloud virtualization technology** : Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization, virtualized data center.
8. **Cloud and SOA** : SOA journey to infrastructure, SOA and cloud, SOA defined, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.

TEXT BOOKS:

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011.

Reference Books

1. Michael Miller, Cloud Computing: Web based applications that change the way you work and collaborate online, Que publishing , August 2009
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On Demand computing applications and data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

Subject Code : 12SCS251
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework.
2. Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-

T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards.

3. Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access.

4. Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution.

5. Network Layer: Introduction, QoS in Network Multimedia Systems.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India , 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.

2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

3. Ralf Steinmetz, Klara Narstedt: Multimedia Fundamentals: Volume 1-Media Coding and Content Processing, 2nd Edition, Pearson, 2003.

4. Prabhat K. Andleigh, Kiran Thakrar: Multimedia Systems Design, PHI, 2003.

Artificial Intelligence and Agent Technology

Subject Code: 12SCS252

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. **Artificial Intelligence:** What is AI., The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, **Intelligent Agents**, Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The structure of Agents.
2. **Solving problems by searching:** Problem-solving Agents, Example problems, Searching for solutions, Uninformed Search Strategies, Avoiding Repeated States, Searching with Partial Information, **Constraint Satisfaction Problems:** Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for Constraint Satisfaction Problems, The Structure of Problems.
3. **Logical Agents:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic , Reasoning Patterns in Propositional Logic Resolution, Effective propositional inference, Agents Based on Propositional Logic, First-Order Logic, Representative Revisited, Syntax and semantics of First-Order Logic, Using First-order Logic, Knowledge Engineering in First-Order Logic.
4. **Uncertainty:** Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Interface using full joint distributions, Independence, Bayes Rule and its use, The Wumpus World Revisited, **Probabilistic Reasoning**, Representing Knowledge in an Uncertain Domain, The semantics of Bayesian Networks, Efficient Representation of conditional distributions, Exact inference in Bayesian networks, Approximate inference in Bayesian Networks, Extending Probability to First-Order representations, Other Approaches to uncertain reasoning.
5. **Learning from Observations:** Forms of Learning, Inductive Learning, Learning Decision Trees, Ensemble Learning, Why Learning Works: computational Learning Theory, Statistical Learning Methods, **Statistical Learning:** Learning with complete data, Learning with Hidden Variables, Instance based Learning, Neural Networks, Kernel Machines, Case Study: Handwritten Digit Recognition, **Philosophical Foundations:** Weak AI, Strong AI, The Ethics and Risks of Developing Artificial Intelligence.

Text Book:

1. Stuart Russel, Peter Norvig: “Artificial Intelligence A Modern Approach”, 2nd Edition, Pearson Education, 2003.

Reference Books:

1. Elaine Rich, Kevin Knight: “Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2009.
2. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, 1980

PROTOCOLS ENGINEERING

Subject Code: 12SCS253

Hours/Week : 04

Total Hours : 52

I.A. Marks : 50

Exam Hours: 03

Exam Marks: 100

1. Introduction: Communication model, Communication Software, Communication Subsystems, Communication Protocol Definition/Representation, Formal and Informal Protocol Development Methods, Protocol Engineering Phases
2. Error Control, Flow Control: Type of Transmission Errors, Linear Block Code, Cyclic Redundancy Checks, Introduction to Flow Control, Window Protocols, Sequence Numbers, Negative Acknowledgments, Congestion Avoidance
3. Network Reference Model: Layered Architecture, Network Services and Interfaces, Protocol Functions: Encapsulation, Segmentation, Reassembly, Multiplexing, Addressing, OSI Model Layer Functions, TCP/IP Protocol Suite, Application Protocols.
4. Protocol Specification: Components of specification, Service specification, Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.
5. Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL, Structure of SDL. Data types and communication paths, Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification, TCP protocol specification, SDL based platform for network, OSPF, BGP Multi Protocol Label Switching SDL components.
6. Protocol Verification / Validation: Protocol Verification using FSM, ABP Verification, Protocol Design Errors, Deadlocks, Unspecified Reception, Non-executable Interactions, State Ambiguities, Protocol Validation Approaches: Perturbation Technique, Reachability Analysis, Fair Reachability Graphs, Process Algebra based Validation, SDL Based Protocol Verification: ABP Verification, Liveness Properties, SDL Based Protocol Validation: ABP Validation.
7. Protocol Conformance and Performance Testing: Conformance Testing Methodology and Framework, Local and Distributed Conformance Test Architectures, Test Sequence Generation Methods: T, U, D and W methods, Distributed Architecture by Local Methods, Synchronizable Test Sequence, Conformance testing with Tree and Tabular Combined Notation (TTCN), Conformance Testing of RIP, Testing

Multimedia Systems, quality of service test architecture(QOS), Performance Test methods, SDL Based Performance Testing of TCP, OSPF, Interoperability testing, Scalability testing protocol synthesis problem

8. Protocol Synthesis and Implementation: Synthesis methods, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis, Requirements of Protocol Implementation, Objects Based Approach To Protocol Implementation, Protocol Compilers, Code generation from Estelle, LOTOS, SDL and CVOPS.

TEXT BOOKS:

1. Pallapa Venkataram and Sunilkumar S. Manvi: Communication Protocol Engineering, PHI, 2004.

REFERENCE BOOKS:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

Semester 3

Information Security

Subject Code : 12SCS31
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Information Security: Introduction; What is security? Critical characteristics of information; NSTISSC security model; Approaches to information security implementation; The Security System Development Life Cycle; Information Security Terminology.
2. Planning for Security: Introduction; Information Security Policy, Standards, and Practices; The Information Security Blue Print.
3. Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting Remote Connections. Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools; Access Control Devices.
4. Information Security maintenance: Introduction; Security Management Models; The Maintenance Model.
5. Introduction to Network Security: Attacks, Services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security; Internet Standards and RFCs; Wireless network security.
6. Cryptography: Conventional Encryption Principles and Algorithms; Cipher Block Modes of Operation; Location of encryption devices; Key distribution; Approaches to message authentication; Secure Hash functions and HMAC; Public Key Cryptography Principles and Algorithms; Digital Signatures; Key management.
7. Authentication Applications: Kerberos, X.509 Directory Authentication Service.
8. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.
9. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.
10. Web Security: Web security requirements, Secure Socket layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET).
11. Software: Introduction; Software flaws; Malware; Software-based attacks; Digital Rights Management;

TEXT BOOKS:

1. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.
2. William Stallings: Network Security Essentials Applications and Standards, Person, 2000.
3. Deven N. Shah: Information Security – Principles and Practice, Wiley India, 2009.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Cryptography and Network Security, Tata McGraw-Hill, 2007.

Wireless and Cellular Networks

Subject Code : 12SCS321
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications Mobil Radio Systems around the world examples of Wireless Communication Systems, Paging System, Cordless Telephone System. Cellular Telephone Systems, Comparison of Common Wireless Communications Systems.
2. Modern Wireless Communications Systems: Second generation (2G), Cellular Networks, evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANS)
3. The Cellular Concept: System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference.
4. Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering.
5. Modulation Techniques for Mobile Radio: Frequency modulation Vs amplitude modulation, Amplitude modulation, Angle modulation, Digital Modulation, Linear Modulation techniques – Binary phases shift keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Constant envelope modulation – Binary Frequency Shift Keying, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK).
6. Multiple Access Techniques for Wireless Communications: Introduction to Multiple access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), Packet Radio. Protocols,

Reservation Protocols – Reservation ALOHA, Packet Reservation Multiple Access (PRMA), Capacity of cellular systems.

7. Wireless Networking: Introduction, Difference between Wireless and Fixed Telephone Networks, Development of Wireless Networks, First generation, second generation, third generation.

TEXT BOOKS:

1. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2nd Edition, Pearson Education Asia, 2002.

REFERENCE BOOKS:

1. William C Y Lee: Mobile Communications Engineering Theory and Applications, 2nd Edition, McGraw Hill, 1998.

2. William Stallings: Wireless Communications and Networks, Pearson Education Asia, 2002.

Storage Area Networks

Subject Code : 12SCS322

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access.

2. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

3. I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

4. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

5. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

6. Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

7. SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

8. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

9. Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2007.

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – A n Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.

2. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2003.

3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Advances in Pattern Classification

Subject Code : 12SCS323

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. Introduction: Polynomial Curve Fitting, Probability Theory, Probability Distributions, Model Selection, Decision Theory, Information Theory

2. Linear Models for Regression: Linear Basis Function Models, The Bias Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison, The Evidence Approximation, Limitations of Fixed Basis Functions

3. Linear Models for Classification: Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, The Laplace Approximation, Bayesian Logistic Regression

4. Kernel Methods: Dual Representations, Constructing Kernels, RBF Networks, Gaussian Processes, Sparse Kernel Machines: SVMs, Multiclass SVMs, Relevance Vector Machines

5. Unsupervised Learning: Introduction, Association Rules, Cluster Analysis, Self-Organizing Maps, Principal Components, Curves and Surfaces, Non-negative Matrix Factorization, Independent Component Analysis and Exploratory Projection Pursuit, Multidimensional Scaling, Nonlinear Dimension Reduction and Local Multidimensional Scaling, The Google PageRank Algorithm

6. Mixture Models and EM: Mixtures of Gaussians, An alternative view of EM, The EM Algorithm in general.

7. High-Dimensional Problems: The Curse of Dimensionality, Diagonal Linear Discriminant Analysis and Nearest Shrunken Centroids, Linear Classifiers with Quadratic Regularization, Linear Classifiers with L1 Regularization, Classification when Features are Unavailable, High-Dimensional Regression: Supervised Principal Components, Feature Assessment and the Multiple-Testing Problem.

Text Books:

1. Christopher M Bishop: Pattern Recognition and Machine Learning, Springer, 2006.
2. Trevor Hastie, Robert Tibshirani, and Jerome Friedman: The Elements of Statistical Learning, Springer, 2008.

Reference Books:

1. R. O. Duda, P. E. Hart, and D. G. Stork: Pattern Classification by 2nd edition, Wiley –Interscience , 2001.
2. Sergios Theodoridis and Konstantinos Koutroumbas: Pattern Recognition, 2nd Edition, Elsevier, 2003.

MULTI-CORE ARCHITECTURE & PROGRAMMING

Subject Code : 12SCS324
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Multi-core Architecture

Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

2. System Overview of Threading

Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

3. Fundamental Concepts of Parallel Programming

Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

4. Threading and Parallel Programming Constructs

Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.

5. Threading APIs

Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

6. OpenMP: A Portable Solution for Threading

Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

7. Solutions to Common Parallel Programming Problems

Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Analysis of Computer Networks

Subject Code : 12SCS331
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; The importance of quantitative modeling in the Engineering of Telecommunication Networks.

2. Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

3. Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

3. Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

4. Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; Sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999.

Data Mining & Warehousing

Subject Code : 12SCS332

No of Lecture Hrs/Week : 4

Total No of Lecture Hours : 52

IA Marks : 50

Exam hours : 3

Exam Marks : 100

1. INTRODUCTION:

What is a Data Warehouse?, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, From Data warehousing to Data Mining, Data Mining Functionalities, Data cleaning, Data Integration and Transformation, Data Reduction.

12 HOURS.

2. DATA MINING PRIMITIVES, LANGUAGES AND SYSTEM ARCHITECTURES: Data Mining primitives, Presentation and Visualization of Discovered patterns, A Data Mining Query Language.

07 HOURS.

3 MINING ASSOCIATION RULES IN LARGE DATA BASES: Association Rule Mining Single – Dimensional Boolean Association Rules From Transactional Databases, Mining Multilevel Association Rules from Transactional Databases. 07 HOURS.

4 CLASSIFICATION AND PREDICTION: Issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification, Classification by back propagation, Classification Based on the concepts from association rule mining. Other classification methods, prediction.

08 HOURS.

5 CLUSTER ANALYSIS: What is Cluster Analysis? Types of data in cluster Analysis: a Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Model-Based Clustering Methods: Statistical Approach, Neural Network Approach Outliner Analysis.

12 HOURS.

6 APPLICATIONS AND TRENDS IN DATA MINING: Data mining application, Data mining system Products research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Trends in Data Mining. 06 HOURS.

Text Books:

1. Jiawei Michelin Kamber, "Data Mining Concepts and Techniques", Morgan Kauf Mann Publishers.

Advances in VLSI Design and Algorithms

Subject Code : 12SCS333
No of Lecture Hrs/Week : 4
Total No of Lecture Hours : 52

IA Marks : 50
Exam hours : 3
Exam Marks : 100

1. Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing;

Integrated Circuit Design Techniques; IP-Based Design.

2. Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

3. Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

4. Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

5. Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

6. Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

TEXT BOOKS:

1. Wayne Wolf: "Modern VLSI design", 3rd edition, Pearson Education, 2007.
2. Sabih H Gerez: "Algorithms for VLSI Design Automation", Wiley India, 2007,

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCS11	Advances in Operating Systems	4	--	03	50	100	150	4
14SCS12	Cloud Computing	4	2 *	03	50	100	150	4
14SCS13	Advances in Data Base Management System	4	2 *	03	50	100	150	4
14SCS14	Multi Core Architecture and Programming	4	2	03	50	100	150	4
14SCS15x	Elective – I	4	2	03	50	100	150	4
14SCS16	Advances in Operating Systems Laboratory	0	3	03	25	50	75	2
14SCS17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I:

14SCS152 Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS21	Managing Big Data	4	2 *	03	50	100	150	4
14SCS22	Advances in Computer Networks	4	2 *	03	50	100	150	4
14SCS23	Advanced Algorithms	4	--	03	50	100	150	4
14SCS24	Artificial Intelligence and Agent Technology	4	2	03	50	100	150	44
14SCS25x	Elective – II	4	2	03	50	100	150	4
14SCS26	Advanced Algorithms Laboratory	0	3	03	25	50	75	2
14SCS27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCS252 Information and Network Security

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork		I.A.	Exam		
14SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *	--	--	--	25	--	25	1
14SCS32	Report on Internship **	--	--	--	--	75	75	15
14SCS33	Evaluation and Viva-voce	--	--	3	--	50	50	4
Total		--	--	3	25	125	150	20

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching					Total Marks	CREDITS
		hours/week		Duration of Exam in Hours	Marks for			
		Lecture	Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS41	Machine Learning Techniques	4	2 *	03	50	100	150	4
14SCS42x	Elective-III	4	2	03	50	100	150	4
14SCS43	Evaluation of Project Phase-II	0	--	0	25	--	25	1
14SCS44	Evaluation of Project Phase-III	0	--	0	25	--	25	1
14SCS45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	200	18
Total		08	07	09	150	400	550	28
Grand Total (I to IV Sem.)			Marks: 2400 ;		Credits : 94			

Elective – III

14SCS423 Agile Technologies

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1).Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase = III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 (50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce).

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Semester: I

Year: 2014-2015

Course Title: Advances In Operating Systems	Course Code: 14SCS11
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating Systems.

TOPICS:

MODULE I

Operating System Overview, Process description & control

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management.

10 Hours

Module II

Threads, SMP, and Microkernel, Virtual Memory.

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Vista Thread and SMP Management, Solaris Thread and SMP Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.

10 Hours

Module III

Multiprocessor and Real-Time Scheduling

Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

10 Hours

Module IV

Embedded Operating Systems

Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

10 Hours

MODULEV

Kernel Organization

Using Kernel Services, Daemons, Starting the Kernel , Control in the Machine , Modules and Device Management, MODULEOrganization, MODULEInstallation and Removal, Process and Resource Management, Running Process

Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management.

The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager , Kernel local procedure calls and IPC, The native API, subsystems.

10 Hours

Course Outcomes:

The students should be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Semester: I

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCS12
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.

Topics:

Module I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

Module II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

Module III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

Module IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

Module V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment (**Eg; Amazon cloud**) and **VM ware for resource virtualization.**

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a *web-hosting application service*, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for

a. Strassen's Matrix Multiplication for a huge matrix.

b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on

the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor

with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must re compute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:

The students should be able to:

- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Course Title: Advances in Database Management Systems	Course Code: 14SCS13
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented database
- To understand the basic concepts, principles of intelligent databases.
- To understand the advanced topics of data warehousing and mining .
- To learn emerging and advanced data models
- To acquire inquisitive attitude towards research topics in databases.

Topics:**MODULE I**

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II

Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition language, ODL, Object Query Language, OQL, Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of: SQL, Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV

Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

10 Hours

LABORATORY WORK:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.
2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.
3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:
 - a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
 - b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.
4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Course Title: Multi-Core Architecture and Programming	Course Code: 14SCS14
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:**MODULE I**

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **10 Hours**

Module II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours**MODULE III**

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours**MODULE IV**

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared

Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

Course Outcomes:

The students should be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Course Title: Advances in Digital Image Processing	Course Code: 14SCS151
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:**MODULE I**

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

10 Hours**MODULE II**

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

10 Hours**MODULE III**

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

10 Hours**MODULE IV**

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **Wavelets and Multiresolution Processing:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image Compression:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

10 Hours**MODULE V:**

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

10 Hours

Course Outcomes:

The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image
- Apply algorithms in practical applications.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005

REFERENCES:

- 1.A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
- 2.Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Semester: I

Year: 2014-2015

Course Title: Advances in Storage Area Networks	Course Code: 14SCS152
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management,

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept,
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Downloaded from A-ZShiksha.com

Course Title: Embedded Computing Systems	Course Code: 14SCS153
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COUR
SE**OBJECTIVES**

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:**MODULE I**

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

7 Hours**MODULE II**

Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours**MODULE III**

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours**MODULE IV**

Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

10 Hours**MODULE V**

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. **Introduction to embedded**

software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:

The students should be able to:

- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:

1. **Raj Kamal**, “Embedded Systems: Architecture, Programming, and Design” 2nd edition , Tata McGraw hill-2013

Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

2. **Marilyn Wolf** ,“Computer as Components, Principles of Embedded Computing System Design” 3rd edition , Elsevier-2014 .

Course Title: Advances in Computer Graphics	Course Code: 14SCS154
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:**MODULE I**

Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bzier Surfaces B-Spline Curves, B-Spline Surfaces, Beta- Splines, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and rfaces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours**MODULE II**

Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions.

10 Hours**MODULE III**

Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping, OpenGL Illumination and surface-rendering functions, openGL texture functions.

10 Hours**MODULE IV**

Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications. Raster methods for computer animation, Design of animations sequences, Traditional animation techniques,

General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V

Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using OpenGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:

The students are able to :

- Represent and implement images and objects using 3D representation and OpenGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:

1. Computer Graphics with OpenGL-Hearn Baker 4rd edition, Pearson publication.2010 (Chapter 8,9,10.12.13.14,15)
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013

Reference Books:

1. Edward Angel: Interactive Computer graphics a top-down approach with OpenGL, Addison Wesley, 6th edition 2012
2. Advanced graphics programming using OpenGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005

Semester: I

Year: 2014-2015

Course Title: Advances in Operating Systems Laboratory	Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/ any equivalent language or tool with suitable platform.

1. Design and Develop a shell that should support at least 20 commands.
2. Design and develop a program to implement lazy buddy system algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
5. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:

- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Course Title: Managing Big Data	Course Code: 14SCS21
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:**MODULE I**

UNDERSTANDING BIG DATA 10 Hours What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

MODULE II

NOSQL DATA MANAGEMENT 10 Hours Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – version – Mapreduce – partitioning and combining – composing map-reduce calculations

MODULE III**BASICS OF HADOOP****10 Hours**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

MODULE IV

MAPREDUCE APPLICATIONS 10 Hours MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V

HADOOP RELATED TOOLS 10 Hours Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LAB Experiments**Exercise 1 --- HDFS**

Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the `hadoop fs` command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file `foo.txt` from local disk to the user's directory in HDFS
3. Get a directory listing of the user's home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file `user/fred/bar.txt`
6. Move that file to the local disk, named as `baz.txt`
7. Create a directory called `input` under the user's home directory
8. Delete the directory `input` and all its contents
9. Verify the copy by listing the directory contents in HDFS:

Exercise 2 --- MapReduce

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

Exercise 3 --- MapReduce (Programs)

Using movie lens data

1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

Exercise4 – Extract facts using Hive

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The `moveapp_log_json` table contains an activity column. Activity states are as follows:

1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE

```

hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json (
custId INT,
movieId INT,
genreId INT,
time STRING,
recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json

```

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.
3. Load the results of the previous two queries into a staging table. First, create the staging table:
4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce

tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.
2. Group the log sample by movie and dump the resulting bag.

3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

Course Outcomes:

The students should be able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.

REFERENCES:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
4. Alan Gates, "Programming Pig", O'Reilly, 2011.

Course Title: Advances in Computer Networks	Course Code: 14SCS22
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To become familiar with the basics of Computer Networks
- To understand various Network architectures
- Concepts of fundamental protocols
- To understand the network traffic, congestion, controlling and resource allocation.

Topics:**MODULE I****Foundation**

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4 10 Hours

MODULE II**Internetworking- I**

Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2, 10 Hours

MODULE III**Internetworking- II**

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

Chapter 3.3, 4.1.1,4.1.3 **T2:Chapter 13.1 to 13.18 , Ch 18. T1: 10 Hours**

MODULE IV**End-to-End Protocols**

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 10 Hours

MODULE V**Congestion Control and Resource Allocation**

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP) .

T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 10 Hours

Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Interfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill

Course Title: Advanced Algorithms	Course Code: 14SCS23
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:**MODULE I**

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours**MODULE II**

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours**MODULE III**

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours**MODULE IV**

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours**MODULE V**

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Semester: II

Year: 2014-2015

Course Title: Artificial Intelligence and Agent Technology	Course Code: 14SCS24
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

TOPICS:

MODULE I

What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.

Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. **Intelligent Agents:** Agents and Environments, The nature of environments, The structure of agents.

Text Book 1: Chapter 1 & 2

Text Book 2: Chapter 2

10 Hours

MODULE II

Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.

Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6

10 Hours

MODULE III

Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.

Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited.

Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13

10Hours

MODULE IV

Weak Slot-and-filter structures: Semantic Nets, Frames.

Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary

Text Book 1: Chapter 9 & 10 Text Book 2: Chapter 5

10 Hours

MODULE V

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Text Book 2: Chapter 18 & 20

10 Hours

COURSE OUTCOMES:

The students are able to:

- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

Text Books.

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books:

3. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

Semester: II

Year: 2014-2015

Course Title: Web Services	Course Code: 14SCS251
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

TOPICS:

MODULE I

Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **10 Hours**

MODULE II

Web Services: Web Services Technologies, Web Services Architecture. **10 Hours**

MODULE III

Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards. **10 Hours**

MODULE IV

Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **10 Hours**

MODULE V

Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example. **10 Hours**

Course Outcomes:

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Course Title: Information And Network Security	Course Code: 14SCS252
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:**MODULE I****Classical Encryption Techniques**

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours**MODULE II**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems, public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours**MODULE III**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure .**User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours**MODULE IV**

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, . **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic

Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

10 Hours

Course Outcomes:

The students be able to

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

References

1. V k Pachghare: Cryptography and Information Security, PHE ,2013.

Semester: II

Year: 2014-2015

Course Title : Pattern Recognition	Course Code: 14SCS253
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

10 Hours

MODULE II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

10 Hours

MODULE III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

10 Hours

MODULE IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

10 Hours

MODULE V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples.

10 Hours

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Develop and analyze decision trees.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

References

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

Course Title: Optical Networks	Course Code: 14SCS254
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors -
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:**MODULE I**

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours**MODULE II****WDM Network Elements**

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours**MODULE III****Control and Management**

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours**MODULE IV****Basic Concepts, Protection in SONET/SDH:**

Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1: N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design:

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES:

The students will be able to:

- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Semester: II

Year: 2014-2015

Course Title: Advanced Algorithms Laboratory	Course Code: 14SCS26
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/language by adapting exception handling technique wherever it is suitable.

1. Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2. Design, develop, and write a program to implement a Monte Carlo algorithm to test the **primality** of a given integer and determine its performance.
3. Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4. Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.
5. Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes:

Upon completion of the course, the students will be able to

- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Course Title: Machine Learning Techniques	Course Code: 14SCS41
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

TOPICS:**MODULE I****INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **10 Hrs**

MODULE II**NEURAL NETWORKS AND GENETIC ALGORITHMS**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **10 Hrs**

MODULE III**BAYESIAN AND COMPUTATIONAL LEARNING**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **10 Hrs**

MODULE IV**INSTANT BASED LEARNING AND LEARNING SET OF RULES**

K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **10 Hrs**

MODULE V**ANALYTICAL LEARNING AND REINFORCED LEARNING**

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **10 Hrs**

LABORATORY WORK

(The following tasks can be implemented in a language of your choice or any tools available)

- 1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
- 2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.

- 3) Implement the ID3 algorithm for learning Boolean-valued functions for classifying the training examples by searching through the space of a Decision Tree.
- 4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
- 5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES:

2. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Course Title: Computer Vision	Course Code: 14SCS421
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:**MODULE I**

CAMERAS: Pinhole Cameras, **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

10 Hours**MODULE II**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

10 Hours**MODULE III**

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

10 Hours**MODULE IV**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

10 Hours**MODULE V**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, **Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into

Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model- Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **10 Hours**

Course Outcomes:

Upon completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

4. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Course Title: Business Intelligence And Its Applications	Course Code: 14SCS422
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:**MODULE I**

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

10 Hours**MODULE II**

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours**MODULE III**

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours**MODULE IV**

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

10 Hours**MODULE V**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework

- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

3. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
4. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
5. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

Course Title: Agile Technologies	Course Code: 14SCS423
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **10 Hours**

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **10 Hours**

MODULE III

Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

10 Hours

MODULE IV

Mastering Agility

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence** :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

COURSE OUTCOMES

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
- 2., "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

Course Title: Wireless Networks And Mobile Computing	Course Code: 14SCS424
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To understand CDMA, GSM, Mobile IP, Wimax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Wireless Networks :** Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

10 Hours

MODULE II

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

10 Hours

MODULE III

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours

MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:

The student should be able to:

- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDP let model and security concerns

TEXT BOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCS11	Advances in Operating Systems	4	-	3	20	80	100	4
16SCS12	Cloud Computing	4	--	3	20	80	100	4
16SCS13	Advances in Data Base Management System	4	--	3	20	80	100	4
16SCS14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCS15x	Course Electives – I	3	--	3	20	80	100	3
16SCS16	Operating Systems and ADBMS Laboratory	--	3(2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCS17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives 1	
16SCS153	Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017
M. Tech. (Computer Science & Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCS11	Advances in Operating Systems	4	-	3	20	80	100	4
16SCS12	Cloud Computing	4	--	3	20	80	100	4
16SCS13	Advances in Data Base Management System	4	--	3	20	80	100	4
16SCS14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCS15x	Course Electives – I	3	--	3	20	80	100	3
16SCS16	Operating Systems and ADBMS Laboratory	--	3(2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCS17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives 1	
16SCS151	Advances in Digital Image Processing
16SCS152	Embedded Computing Systems
16SCS153	Advances in Storage Area Networks
16SCS154	Advances in Computer Graphics

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.			10Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.			10 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS • Perform map-reduce analytics using Hadoop 			

- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
4. Alan Gates, "Programming Pig", O'Reilly, 2011

ADVANCES IN COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN12/16SCS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Discuss with the basics of Computer Networks. • Compare various Network architectures. • Discuss fundamental protocols. • Define and analyze network traffic, congestion, controlling and resource allocation. 			
Module 1			Teaching Hours
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4			10 Hours
Module 2			
Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2,			10 Hours
Module 3			
Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18.			10 Hours
Module 4			
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3			10 Hours
Module 5			
Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • List and classify network services, protocols and architectures, explain why they are layered. 			

- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014.

Reference Books:

1. Uyles Black, “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI.
2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill.

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCS23/ 16SSE253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define the graph search algorithms. • Explain network flow and linear programming problems. • Interpret hill climbing and dynamic programming design techniques. • Develop recursive backtracking algorithms. • Define NP completeness and randomized algorithms 			
Module -1			Teaching Hours
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.			10Hours
Module -2			
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson’s Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.			10 Hours
Module – 3			
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization			10 Hours
Module-4			
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.			10 Hours
Module-5			
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.			10 Hours
Course outcomes:			

<p>Upon completion of the course, the students will be able to</p> <ul style="list-style-type: none"> • Design and apply iterative and recursive algorithms. • Design and implement optimization algorithms in specific applications. • Design appropriate shared objects and concurrent objects for applications.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010. 2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

<p align="center">INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II</p>			
Subject Code	16LNI253 /16SCE253 /16SCN151 /16SCS24 /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
<p align="center">CREDITS – 04</p>			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
<p>What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.</p>			10Hours
Module -2			

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches,IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol,Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPV6 Over Lowpower WPAN, Zigbee IP(ZIP),IPSO	10 Hours
Module – 3	
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT:Overview and Motivations.Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes,Quality of Service in IPv6, Migration Strategies to IPv6.	10 Hours
Module-4	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.	10 Hours
Module-5	
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.	10 Hours
Course outcomes:	
At the end of this course the students will be able to: <ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business • Understand the practical knowledge through different case studies • Understand data sets received through IoT devices and tools used for analysis 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013. 2. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands on Approach" Universities Press., 2015	
Reference Books:	
1. Michael Miller," The Internet of Things", First Edition, Pearson, 2015. 2. Claire Rowland,Elizabeth Goodman et.al.," Designing Connected Products", First Edition,O'Reilly, 2015.	

ARTIFICIAL INTELLIGENCE AND AGENT TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16SCS251	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			

<ul style="list-style-type: none"> • Apply a given AI technique to a given concrete problem • Implement non-trivial AI techniques in a relatively large system • Explain uncertainty and Problem solving techniques. • Illustrate various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent. • Contrast different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification. • Compare various learning techniques and agent technology. 	
Module -1	Teaching Hours
<p>What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. Intelligent Agents: Agents and Environments, The nature of environments, The structure of agents. Text Book 1: Chapter 1 & 2 Text Book 2: Chapter 2</p>	8 Hours
Module -2	
<p>Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction. Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6</p>	8 Hours
Module – 3	
<p>Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search. Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic. Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes’ rule and its use, The Wumpus world revisited. Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13</p>	8 Hours
Module-4	
<p>Weak Slot-and-filter structures: Semantic Nets, Frames. Strong slot-and –filler structures: Conceptual dependency, scripts, CYC. Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary. Text Book 1: Chapter 9 & 10Text Book 2: Chapter 5</p>	8 Hours
Module-5	
<p>Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning. Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm. Text Book 2: Chapter 18 & 20</p>	8 Hours
Course outcomes:	
<p>The students are able to:</p> <ul style="list-style-type: none"> • Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of 	

<p>existing algorithms.</p> <ul style="list-style-type: none"> • Apply AI technique on current applications. • Problem solving, knowledge representation, reasoning, and learning.
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013 2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

PATTERN RECOGNITION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16SCE252/ 16SCS252	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain various Image processing and Pattern recognition techniques. • Illustrate mathematical morphology necessary for Pattern recognition. • Demonstrate Image Representation and description and feature extraction. • Explain principles of decision trees and clustering in pattern recognition. 			
Module -1			Teaching Hours
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems			8 Hours
Module -2			
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation			8 Hours
Module – 3			
Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive bayes classifier, Bayesian belief network			8 Hours
Module-4			
Naive bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM			8 Hours
Module-5			
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards,			8 Hours

Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition	
Course outcomes:	
The students shall able to: <ul style="list-style-type: none"> • Explain pattern recognition principals • Develop algorithms for Pattern Recognition. • Develop and analyze decision tress. • Design the nearest neighbor classifier. • Apply Decision tree and clustering techniques to various applications 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, 2011 Universities Press, ISBN 978-81-7371-725-3 2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PH ISBN-81-203-1484-0, 1996. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000. 	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI12/16SCN13/16SCS253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Teaching Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm			8 Hours
Module 2			
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.			8 Hours
Module 3			
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.			8 Hours
Module 4			
Wireless network security: Wireless security, Wireless network threats, Wireless			8 Hours

network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol	
Module 5	
Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.	8 Hours
Course Outcomes	
The students should be able to:	
<ul style="list-style-type: none"> Analyze the vulnerabilities in any computing system and hence be able to design a security solution. Identify the security issues in the network and resolve it. Evaluate security mechanisms using rigorous approaches, including theoretical. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. William Stallings, Cryptography and Network Security, Pearson 6 th edition.	
Reference Books:	
1. V K Pachghare: Cryptography and Information Security.	

WEB SERVICES			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – II			
Subject Code	16SCS254 / 16SSE154 / 16LNI252 / 16SIT21	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			

<ul style="list-style-type: none"> • Define and explain Web Services. • Summarize WSDL Web Services. • Analyze Web service Architecture. • Explain Building Blocks of Web services. 	
Module 1	Teaching Hours
Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware.	8 Hours
Module 2	
Web Services: Web Services Technologies, Web Services Architecture.	8 Hours
Module 3	
Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards.	8 Hours
Module 4	
Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols.	8 Hours
Module 5	
Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example.	8 Hours
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> • Bind and unbind services in UDDI. • Develop WSDL document • Implement web service client to call public service. • Implement a service and exposing it as public service. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.	
Reference Books:	
NIL	

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26/ 16SIT26 / 16SSE26	IA Marks	20

Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.			
Course outcomes:			
<ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
Conduction of Practical Examination:			
The student shall prepare the report by including:			
<ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
Evaluation:			
Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20 = 80 marks.			

SEMINAR			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – II			
Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-
CREDITS – 01			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
The students should read a recent technical article (try to narrow down the topic as much as possible)			

from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

MACHINE LEARNING TECHNIQUES [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCS41/16SIT424	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain basic concepts of learning and decision trees. • Compare and contrast neural networks and genetic algorithms • Apply the Bayesian techniques and instant based learning • Examine analytical learning and reinforced learning 			
Module -1			Teaching Hours
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search			10Hours
Module -2			
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.			10 Hours
Module – 3			
BAYESIAN AND COMPUTATIONAL LEARNINGGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes			10 Hours

Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	
Module-4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution	10 Hours
Module-5	
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	10 Hours
Course outcomes:	
On Completion of the course, the students will be able to <ul style="list-style-type: none"> • Choose the learning techniques with this basic knowledge. • Apply effectively neural networks and genetic algorithms for appropriate applications. • Apply bayesian techniques and derive effectively learning rules. • Choose and differentiate reinforcement and analytical learning techniques 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.	
Reference Books: 1. Ethem Alpaydin, “Introduction to Machine Learning”, 2 nd Ed., PHI Learning Pvt. Ltd., 2013. 2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.	

Computer Vision [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCS421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Review image processing techniques for computer vision • Discuss shape and region analysis • Analyze Hough Transform and its applications to detect lines, circles, ellipses • Analyze three-dimensional image analysis techniques • Illustrate motion analysis • Discuss some applications of computer vision algorithms 			

Module -1	Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	8 Hours
Module -2	
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	8 Hours
Module – 3	
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	8 Hours
Module-4	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	8 Hours
Module-5	
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	8 Hours
Course outcomes:	
Upon completion of the course, the students will be able to	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
Question paper pattern:	
The question paper will have ten questions.	
There will be 2 questions from each module.	
Each question will have questions covering all the topics under a module.	
The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning	

(Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

BUSINESS INTELLIGENCE AND ITS APPLICATIONS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SIT421 / 16SCS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Evaluate the key elements of a successful business intelligence (BI) program • Apply a BI meta model that turns outcomes into actions • Extract and transform data from an operational data to a data business data • Evaluate business analytics and performance measurement tools 			
Module -1			Teaching Hours
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation			8 Hours
Module -2			
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process			8 Hours
Module – 3			
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery			8 Hours
Module-4			
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard			8 Hours
Module-5			
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.			8 Hours
Course outcomes:			
<p>Upon completion of the course, the students will be able to</p> <ul style="list-style-type: none"> • Explain the complete life cycle of BI/Analytical development • Illustrate technology and processes associated with Business Intelligence framework • Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal. 			

<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003. 2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4. 2. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006. 3. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

<p>AGILE TECHNOLOGIES [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV</p>			
Subject Code	16SCS423 /16SSE423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain iterative, incremental development process leads to faster delivery of more useful software • Evaluate essence of agile development methods • Illustrate the principles and practices of extreme programming • Show the roles of prototyping in the software process • Explain the Mastering Agility 			
Module -1			Teaching Hours
<p>Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor</p>			8 Hours
Module -2			
<p>Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility</p>			8 Hours
Module – 3			

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: “Done Done”, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing	8 Hours
Module-4	
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People : Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste : Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	8 Hours
Module-5	
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence : Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	8 Hours
Course outcomes:	
Students should be able to <ul style="list-style-type: none"> • Define XP Lifecycle, XP Concepts, Adopting XP • Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests • Demonstrate concepts to Eliminate Waste 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007	
Reference Books:	
1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002 2. Agile and Iterative Development A Manger's Guide”, Craig Larman Pearson Education, First Edition, India, 2004	

WIRELESS NETWORKS AND MOBILE COMPUTING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	16SCE22 / 16SCS424	IA Marks	20
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Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define concepts of wireless communication. • Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication. • Explain CDMA, GSM. Mobile IP, Wimax and Different Mobile OS • Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns 			
Module -1			Teaching Hours
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.			8 Hours
Module -2			
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6			8 Hours
Module – 3			
Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators			8 Hours
Module-4			
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.			8 Hours
Module-5			
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.			8 Hours
Course outcomes:			
The students shall able to:			
<ul style="list-style-type: none"> • Explain state of art techniques in wireless communication. • Discover CDMA, GSM. Mobile IP, Wimax • Demonstrate program for CLDC, MIDP let model and security concerns 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM
(CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech. (Computer Science & Engineering)

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16SCS21	Managing Big Data	4	--	3	20	80	100	4
16SCS22	Advances in Computer Networks	4	--	3	20	80	100	4
16SCS23	Advanced Algorithms	4	--	3	20	80	100	4
16SCS24	Internet of Things	4	--	3	20	80	100	4
16SCS25x	Course Elective - II	4	--	3	20	80	100	3
16SCS26	Mini-project	--	3 hrs lab	3	20	80	100	2
16SCS27	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Elective II	
16SCS253	Information and Network Security

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

III SEMESTER: Internship

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16SCS32	Report on Internship	-	-	-	25	-	25	
3	16SCS33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16SCS34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

IV SEMESTER

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16SCS41	Machine Learning Techniques	4	-	3	20	80	100	4
2	16SCS42x	Course Elective-III	3	-	3	20	80	100	3
3	16SCS43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16SCS44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			7	-	6	90	360	450	20

Elective

16SCS423 Agile Technologies

Note:

1. **Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.
2. **Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
3. **Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
4. **Project evaluation:**
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCS11	Advances in Operating Systems	4	--	03	50	100	150	4
14SCS12	Cloud Computing	4	2 *	03	50	100	150	4
14SCS13	Advances in Data Base Management System	4	2 *	03	50	100	150	4
14SCS14	Multi Core Architecture and Programming	4	2	03	50	100	150	4
14SCS15x	Elective – I	4	2	03	50	100	150	4
14SCS16	Advances in Operating Systems Laboratory	0	3	03	25	50	75	2
14SCS17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I:

14SCS152 Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS21	Managing Big Data	4	2 *	03	50	100	150	4
14SCS22	Advances in Computer Networks	4	2 *	03	50	100	150	4
14SCS23	Advanced Algorithms	4	--	03	50	100	150	4
14SCS24	Artificial Intelligence and Agent Technology	4	2	03	50	100	150	44
14SCS25x	Elective – II	4	2	03	50	100	150	4
14SCS26	Advanced Algorithms Laboratory	0	3	03	25	50	75	2
14SCS27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCS252 Information and Network Security

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork		I.A.	Exam		
14SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *	--	--	--	25	--	25	1
14SCS32	Report on Internship **	--	--	--	--	75	75	15
14SCS33	Evaluation and Viva-voce	--	--	3	--	50	50	4
Total		--	--	3	25	125	150	20

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching					Total Marks	CREDITS
		hours/week		Duration of Exam in Hours	Marks for			
		Lecture	Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS41	Machine Learning Techniques	4	2 *	03	50	100	150	4
14SCS42x	Elective-III	4	2	03	50	100	150	4
14SCS43	Evaluation of Project Phase-II	0	--	0	25	--	25	1
14SCS44	Evaluation of Project Phase-III	0	--	0	25	--	25	1
14SCS45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	200	18
Total		08	07	09	150	400	550	28
Grand Total (I to IV Sem.)			Marks: 2400 ;		Credits : 94			

Elective – III

14SCS423 Agile Technologies

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1).Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase = III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 (50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce).

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Semester: I

Year: 2014-2015

Course Title: Advances In Operating Systems	Course Code: 14SCS11
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating Systems.

TOPICS:

MODULE I

Operating System Overview, Process description & control

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management.

10 Hours

Module II

Threads, SMP, and Microkernel, Virtual Memory.

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Vista Thread and SMP Management, Solaris Thread and SMP Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.

10 Hours

Module III

Multiprocessor and Real-Time Scheduling

Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

10 Hours

Module IV

Embedded Operating Systems

Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

10 Hours

MODULEV

Kernel Organization

Using Kernel Services, Daemons, Starting the Kernel , Control in the Machine , Modules and Device Management, MODULEOrganization, MODULEInstallation and Removal, Process and Resource Management, Running Process

Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management.

The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager , Kernel local procedure calls and IPC, The native API, subsystems.

10 Hours

Course Outcomes:

The students should be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Semester: I

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCS12
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.

Topics:

Module I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

Module II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

Module III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

Module IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

Module V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment (**Eg; Amazon cloud**) and **VM ware for resource virtualization.**

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a *web-hosting application service*, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for

a. Strassen's Matrix Multiplication for a huge matrix.

b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on

the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor

with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must re compute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:

The students should be able to:

- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Course Title: Advances in Database Management Systems	Course Code: 14SCS13
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented database
- To understand the basic concepts, principles of intelligent databases.
- To understand the advanced topics of data warehousing and mining .
- To learn emerging and advanced data models
- To acquire inquisitive attitude towards research topics in databases.

Topics:**MODULE I**

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II

Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition language, ODL, Object Query Language, OQL, Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of: SQL, Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV

Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

10 Hours

LABORATORY WORK:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.
2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.
3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:
 - a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
 - b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.
4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Course Title: Multi-Core Architecture and Programming	Course Code: 14SCS14
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:**MODULE I**

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **10 Hours**

Module II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours**MODULE III**

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours**MODULE IV**

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared

Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

Course Outcomes:

The students should be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Course Title: Advances in Digital Image Processing	Course Code: 14SCS151
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:**MODULE I**

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

10 Hours**MODULE II**

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

10 Hours**MODULE III**

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

10 Hours**MODULE IV**

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **Wavelets and Multiresolution Processing:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image Compression:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

10 Hours**MODULE V:**

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

10 Hours

Course Outcomes:

The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image
- Apply algorithms in practical applications.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005

REFERENCES:

- 1.A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
- 2.Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Semester: I

Year: 2014-2015

Course Title: Advances in Storage Area Networks	Course Code: 14SCS152
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management,

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept,
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Downloaded from A-ZShiksha.com

Course Title: Embedded Computing Systems	Course Code: 14SCS153
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COUR
SE**OBJECTIVES**

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:**MODULE I**

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

7 Hours**MODULE II**

Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours**MODULE III**

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours**MODULE IV**

Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

10 Hours**MODULE V**

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. **Introduction to embedded**

software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:

The students should be able to:

- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:

1. **Raj Kamal**, “Embedded Systems: Architecture, Programming, and Design” 2nd edition , Tata McGraw hill-2013

Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

2. **Marilyn Wolf** ,“Computer as Components, Principles of Embedded Computing System Design” 3rd edition , Elsevier-2014 .

Course Title: Advances in Computer Graphics	Course Code: 14SCS154
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:**MODULE I**

Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bzier Surfaces B-Spline Curves, B-Spline Surfaces, Beta- Splines, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and rfaces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours**MODULE II**

Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions.

10 Hours**MODULE III**

Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping, OpenGL Illumination and surface-rendering functions, openGL texture functions.

10 Hours**MODULE IV**

Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications. Raster methods for computer animation, Design of animations sequences, Traditional animation techniques,

General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V

Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using OpenGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:

The students are able to :

- Represent and implement images and objects using 3D representation and OpenGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:

1. Computer Graphics with OpenGL-Hearn Baker 4rd edition, Pearson publication.2010 (Chapter 8,9,10.12.13.14,15)
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013

Reference Books:

1. Edward Angel: Interactive Computer graphics a top-down approach with OpenGL, Addison Wesley, 6th edition 2012
2. Advanced graphics programming using OpenGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005

Semester: I

Year: 2014-2015

Course Title: Advances in Operating Systems Laboratory	Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/ any equivalent language or tool with suitable platform.

1. Design and Develop a shell that should support at least 20 commands.
2. Design and develop a program to implement lazy buddy system algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
5. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:

- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Course Title: Managing Big Data	Course Code: 14SCS21
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:**MODULE I**

UNDERSTANDING BIG DATA 10 Hours What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

MODULE II

NOSQL DATA MANAGEMENT 10 Hours Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – version – Mapreduce – partitioning and combining – composing map-reduce calculations

MODULE III**BASICS OF HADOOP****10 Hours**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

MODULE IV

MAPREDUCE APPLICATIONS 10 Hours MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V

HADOOP RELATED TOOLS 10 Hours Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LAB Experiments**Exercise 1 --- HDFS**

Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the `hadoop fs` command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file `foo.txt` from local disk to the user's directory in HDFS
3. Get a directory listing of the user's home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file `user/fred/bar.txt`
6. Move that file to the local disk, named as `baz.txt`
7. Create a directory called `input` under the user's home directory
8. Delete the directory `input` and all its contents
9. Verify the copy by listing the directory contents in HDFS:

Exercise 2 --- MapReduce

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

Exercise 3 --- MapReduce (Programs)

Using movie lens data

1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

Exercise4 – Extract facts using Hive

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The `moveapp_log_json` table contains an activity column. Activity states are as follows:

1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE

```

hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json (
custId INT,
movieId INT,
genreId INT,
time STRING,
recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json

```

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.
2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.
3. Load the results of the previous two queries into a staging table. First, create the staging table:
4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce

tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.
2. Group the log sample by movie and dump the resulting bag.

3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

Course Outcomes:

The students should be able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.

REFERENCES:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
4. Alan Gates, "Programming Pig", O'Reilly, 2011.

Course Title: Advances in Computer Networks	Course Code: 14SCS22
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To become familiar with the basics of Computer Networks
- To understand various Network architectures
- Concepts of fundamental protocols
- To understand the network traffic, congestion, controlling and resource allocation.

Topics:**MODULE I****Foundation**

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4 10 Hours

MODULE II**Internetworking- I**

Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2, 10 Hours

MODULE III**Internetworking- II**

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

Chapter 3.3, 4.1.1,4.1.3 **T2:Chapter 13.1 to 13.18 , Ch 18. T1: 10 Hours**

MODULE IV**End-to-End Protocols**

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 10 Hours

MODULE V**Congestion Control and Resource Allocation**

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP) .

T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 10 Hours

Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

References:

1. **Uyless Black** "Computer Networks, Protocols , Standards and Interfaces" 2nd Edition - PHI
2. **Behrouz A Forouzan** "TCP/IP Protocol Suite" 4th Edition – Tata McGraw-Hill

Course Title: Advanced Algorithms	Course Code: 14SCS23
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:**MODULE I**

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours**MODULE II**

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours**MODULE III**

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours**MODULE IV**

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours**MODULE V**

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Semester: II

Year: 2014-2015

Course Title: Artificial Intelligence and Agent Technology	Course Code: 14SCS24
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

TOPICS:

MODULE I

What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.

Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. **Intelligent Agents:** Agents and Environments, The nature of environments, The structure of agents.

Text Book 1: Chapter 1 & 2

Text Book 2: Chapter 2

10 Hours

MODULE II

Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.

Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6

10 Hours

MODULE III

Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.

Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited.

Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13

10Hours

MODULE IV

Weak Slot-and-filter structures: Semantic Nets, Frames.

Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary

Text Book 1: Chapter 9 & 10 Text Book 2: Chapter 5

10 Hours

MODULE V

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Text Book 2: Chapter 18 & 20

10 Hours

COURSE OUTCOMES:

The students are able to:

- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

Text Books.

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books:

3. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

Semester: II

Year: 2014-2015

Course Title: Web Services	Course Code: 14SCS251
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

TOPICS:

MODULE I

Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **10 Hours**

MODULE II

Web Services: Web Services Technologies, Web Services Architecture. **10 Hours**

MODULE III

Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards. **10 Hours**

MODULE IV

Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **10 Hours**

MODULE V

Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example. **10 Hours**

Course Outcomes:

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Course Title: Information And Network Security	Course Code: 14SCS252
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:**MODULE I****Classical Encryption Techniques**

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours**MODULE II**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, Public-key cryptosystems. Applications for public-key cryptosystems, Requirements for public-key cryptosystems, public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours**MODULE III**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours**MODULE IV**

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, . **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic

Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

10 Hours

Course Outcomes:

The students be able to

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

References

1. V k Pachghare: Cryptography and Information Security, PHE ,2013.

Semester: II

Year: 2014-2015

Course Title : Pattern Recognition	Course Code: 14SCS253
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

10 Hours

MODULE II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

10 Hours

MODULE III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

10 Hours

MODULE IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

10 Hours

MODULE V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples.

10 Hours

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Develop and analyze decision trees.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

References

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

Course Title: Optical Networks	Course Code: 14SCS254
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors -
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:**MODULE I**

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours**MODULE II****WDM Network Elements**

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours**MODULE III****Control and Management**

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours**MODULE IV****Basic Concepts, Protection in SONET/SDH:**

Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1: N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design:

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES:

The students will be able to:

- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Semester: II

Year: 2014-2015

Course Title: Advanced Algorithms Laboratory	Course Code: 14SCS26
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/language by adapting exception handling technique wherever it is suitable.

1. Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2. Design, develop, and write a program to implement a Monte Carlo algorithm to test the **primality** of a given integer and determine its performance.
3. Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4. Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.
5. Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes:

Upon completion of the course, the students will be able to

- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Course Title: Machine Learning Techniques	Course Code: 14SCS41
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

TOPICS:**MODULE I****INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **10 Hrs**

MODULE II**NEURAL NETWORKS AND GENETIC ALGORITHMS**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **10 Hrs**

MODULE III**BAYESIAN AND COMPUTATIONAL LEARNING**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **10 Hrs**

MODULE IV**INSTANT BASED LEARNING AND LEARNING SET OF RULES**

K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **10 Hrs**

MODULE V**ANALYTICAL LEARNING AND REINFORCED LEARNING**

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **10 Hrs**

LABORATORY WORK

(The following tasks can be implemented in a language of your choice or any tools available)

- 1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
- 2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.

- 3) Implement the ID3 algorithm for learning Boolean-valued functions for classifying the training examples by searching through the space of a Decision Tree.
- 4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
- 5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES:

2. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Course Title: Computer Vision	Course Code: 14SCS421
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:**MODULE I**

CAMERAS: Pinhole Cameras, **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

10 Hours**MODULE II**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

10 Hours**MODULE III**

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

10 Hours**MODULE IV**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

10 Hours**MODULE V**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, **Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into

Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model- Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **10 Hours**

Course Outcomes:

Upon completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

4. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Course Title: Business Intelligence And Its Applications	Course Code: 14SCS422
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:**MODULE I**

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

10 Hours**MODULE II**

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours**MODULE III**

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours**MODULE IV**

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

10 Hours**MODULE V**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework

- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

3. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
4. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
5. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

Semester: IV

Year: 2014-2015

Course Title: Agile Technologies	Course Code: 14SCS423
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **10 Hours**

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **10 Hours**

MODULE III

Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

10 Hours

MODULE IV

Mastering Agility

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence** :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

COURSE OUTCOMES

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
- 2., "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

Course Title: Wireless Networks And Mobile Computing	Course Code: 14SCS424
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To understand CDMA, GSM, Mobile IP, Wimax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Wireless Networks :** Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

10 Hours

MODULE II

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

10 Hours

MODULE III

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours

MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:

The student should be able to:

- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDP let model and security concerns

TEXT BOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCS11	Advances in Operating Systems	4	-	3	20	80	100	4
16SCS12	Cloud Computing	4	--	3	20	80	100	4
16SCS13	Advances in Data Base Management System	4	--	3	20	80	100	4
16SCS14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCS15x	Course Electives – I	3	--	3	20	80	100	3
16SCS16	Operating Systems and ADBMS Laboratory	--	3(2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCS17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives 1	
16SCS153	Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017
M. Tech. (Computer Science & Engineering)

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		IA.	Exam		
16SCS11	Advances in Operating Systems	4	-	3	20	80	100	4
16SCS12	Cloud Computing	4	--	3	20	80	100	4
16SCS13	Advances in Data Base Management System	4	--	3	20	80	100	4
16SCS14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCS15x	Course Electives – I	3	--	3	20	80	100	3
16SCS16	Operating Systems and ADBMS Laboratory	--	3(2 Hrs lab+ 1 Hr Instruction)	3	20	80	100	2
16SCS17	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Electives 1	
16SCS151	Advances in Digital Image Processing
16SCS152	Embedded Computing Systems
16SCS153	Advances in Storage Area Networks
16SCS154	Advances in Computer Graphics

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.			10Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			10 Hours
Module – 3			
BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.			10 Hours
Module-4			
MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats			10 Hours
Module-5			
HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.			10 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS • Perform map-reduce analytics using Hadoop 			

- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

Reference Books:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011

ADVANCES IN COMPUTER NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCN12/16SCS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Discuss with the basics of Computer Networks. • Compare various Network architectures. • Discuss fundamental protocols. • Define and analyze network traffic, congestion, controlling and resource allocation. 			
Module 1			Teaching Hours
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4			10 Hours
Module 2			
Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. T1: Chapter 3.1, 3.2,			10 Hours
Module 3			
Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP T1: Chapter 3.3, 4.1.1,4.1.3 T2:Chapter 13.1 to 13.18 , Ch 18.			10 Hours
Module 4			
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3			10 Hours
Module 5			
Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8			10 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • List and classify network services, protocols and architectures, explain why they are layered. 			

- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Question paper pattern:

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition , Elsevier -2014.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI – 2014.

Reference Books:

1. Uyles Black, “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI.
2. Behrouz A Forouzan, “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill.

ADVANCED ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCS23/ 16SSE253	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Define the graph search algorithms. • Explain network flow and linear programming problems. • Interpret hill climbing and dynamic programming design techniques. • Develop recursive backtracking algorithms. • Define NP completeness and randomized algorithms 			
Module -1			Teaching Hours
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.			10Hours
Module -2			
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson’s Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.			10 Hours
Module – 3			
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization			10 Hours
Module-4			
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.			10 Hours
Module-5			
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.			10 Hours
Course outcomes:			

<p>Upon completion of the course, the students will be able to</p> <ul style="list-style-type: none"> • Design and apply iterative and recursive algorithms. • Design and implement optimization algorithms in specific applications. • Design appropriate shared objects and concurrent objects for applications.
<p>Question paper pattern:</p> <p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010. 2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

INTERNET OF THINGS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI253 /16SCE253 /16SCN151 /16SCS24 /16SIT251 /16SSE421	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			10Hours
Module -2			

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches,IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol,Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPV6 Over Lowpower WPAN, Zigbee IP(ZIP),IPSO	10 Hours
Module – 3	
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT:Overview and Motivations.Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes,Quality of Service in IPv6, Migration Strategies to IPv6.	10 Hours
Module-4	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.	10 Hours
Module-5	
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.	10 Hours
Course outcomes:	
At the end of this course the students will be able to: <ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business • Understand the practical knowledge through different case studies • Understand data sets received through IoT devices and tools used for analysis 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013. 2. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands on Approach" Universities Press., 2015	
Reference Books:	
1. Michael Miller," The Internet of Things", First Edition, Pearson, 2015. 2. Claire Rowland,Elizabeth Goodman et.al.," Designing Connected Products", First Edition,O'Reilly, 2015.	

ARTIFICIAL INTELLIGENCE AND AGENT TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16SCS251	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS - 03			
Course objectives: This course will enable students to			

<ul style="list-style-type: none"> • Apply a given AI technique to a given concrete problem • Implement non-trivial AI techniques in a relatively large system • Explain uncertainty and Problem solving techniques. • Illustrate various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent. • Contrast different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification. • Compare various learning techniques and agent technology. 	
Module -1	Teaching Hours
<p>What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. Intelligent Agents: Agents and Environments, The nature of environments, The structure of agents. Text Book 1: Chapter 1 & 2 Text Book 2: Chapter 2</p>	8 Hours
Module -2	
<p>Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction. Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6</p>	8 Hours
Module – 3	
<p>Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search. Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic. Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes’ rule and its use, The Wumpus world revisited. Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13</p>	8 Hours
Module-4	
<p>Weak Slot-and-filter structures: Semantic Nets, Frames. Strong slot-and –filler structures: Conceptual dependency, scripts, CYC. Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary. Text Book 1: Chapter 9 & 10Text Book 2: Chapter 5</p>	8 Hours
Module-5	
<p>Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning. Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm. Text Book 2: Chapter 18 & 20</p>	8 Hours
Course outcomes:	
<p>The students are able to:</p> <ul style="list-style-type: none"> • Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of 	

<p>existing algorithms.</p> <ul style="list-style-type: none"> • Apply AI technique on current applications. • Problem solving, knowledge representation, reasoning, and learning.
<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013 2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

PATTERN RECOGNITION [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16SCE252/ 16SCS252	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain various Image processing and Pattern recognition techniques. • Illustrate mathematical morphology necessary for Pattern recognition. • Demonstrate Image Representation and description and feature extraction. • Explain principles of decision trees and clustering in pattern recognition. 			
Module -1			Teaching Hours
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems			8 Hours
Module -2			
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation			8 Hours
Module – 3			
Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive bayes classifier, Bayesian belief network			8 Hours
Module-4			
Naive bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over fitting & Pruning, Examples, Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM			8 Hours
Module-5			
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards,			8 Hours

Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition	
Course outcomes:	
The students shall able to: <ul style="list-style-type: none"> • Explain pattern recognition principals • Develop algorithms for Pattern Recognition. • Develop and analyze decision tress. • Design the nearest neighbor classifier. • Apply Decision tree and clustering techniques to various applications 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
<ol style="list-style-type: none"> 1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, 2011 Universities Press, ISBN 978-81-7371-725-3 2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PH ISBN-81-203-1484-0, 1996. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000. 	

INFORMATION AND NETWORK SECURITY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI12/16SCN13/16SCS253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain standard algorithms used to provide confidentiality, integrity and authenticity. • Distinguish key distribution and management schemes. • Deploy encryption techniques to secure data in transit across data networks • Implement security applications in the field of Information technology 			
Module 1			Teaching Hours
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm			8 Hours
Module 2			
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.			8 Hours
Module 3			
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.			8 Hours
Module 4			
Wireless network security: Wireless security, Wireless network threats, Wireless			8 Hours

network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. HTTPS Connection Initiation, Connection Closure. Secure Shell(SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol	
Module 5	
Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.	8 Hours
Course Outcomes	
The students should be able to:	
<ul style="list-style-type: none"> Analyze the vulnerabilities in any computing system and hence be able to design a security solution. Identify the security issues in the network and resolve it. Evaluate security mechanisms using rigorous approaches, including theoretical. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. William Stallings, Cryptography and Network Security, Pearson 6 th edition.	
Reference Books:	
1. V K Pachghare: Cryptography and Information Security.	

WEB SERVICES			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – II			
Subject Code	16SCS254 / 16SSE154 / 16LNI252 / 16SIT21	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			

<ul style="list-style-type: none"> • Define and explain Web Services. • Summarize WSDL Web Services. • Analyze Web service Architecture. • Explain Building Blocks of Web services. 	
Module 1	Teaching Hours
Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware.	8 Hours
Module 2	
Web Services: Web Services Technologies, Web Services Architecture.	8 Hours
Module 3	
Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards.	8 Hours
Module 4	
Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols.	8 Hours
Module 5	
Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example.	8 Hours
Course Outcomes	
The students should be able to: <ul style="list-style-type: none"> • Bind and unbind services in UDDI. • Develop WSDL document • Implement web service client to call public service. • Implement a service and exposing it as public service. 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.	
Reference Books:	
NIL	

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26/ 16SIT26 / 16SSE26	IA Marks	20

Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.			
Course outcomes:			
<ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
Conduction of Practical Examination:			
The student shall prepare the report by including:			
<ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
Evaluation:			
Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20 = 80 marks.			

SEMINAR			
[As per Choice Based Credit System (CBCS) scheme]			
(Effective from the academic year 2016 -2017)			
SEMESTER – II			
Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-
CREDITS – 01			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
The students should read a recent technical article (try to narrow down the topic as much as possible)			

from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.
3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).

MACHINE LEARNING TECHNIQUES [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCS41/16SIT424	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Explain basic concepts of learning and decision trees. • Compare and contrast neural networks and genetic algorithms • Apply the Bayesian techniques and instant based learning • Examine analytical learning and reinforced learning 			
Module -1			Teaching Hours
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search			10Hours
Module -2			
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.			10 Hours
Module – 3			
BAYESIAN AND COMPUTATIONAL LEARNINGGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes			10 Hours

Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	
Module-4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution	10 Hours
Module-5	
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning	10 Hours
Course outcomes:	
On Completion of the course, the students will be able to <ul style="list-style-type: none"> • Choose the learning techniques with this basic knowledge. • Apply effectively neural networks and genetic algorithms for appropriate applications. • Apply bayesian techniques and derive effectively learning rules. • Choose and differentiate reinforcement and analytical learning techniques 	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.	
Reference Books: 1. Ethem Alpaydin, “Introduction to Machine Learning”, 2 nd Ed., PHI Learning Pvt. Ltd., 2013. 2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.	

Computer Vision [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16SCS421	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Review image processing techniques for computer vision • Discuss shape and region analysis • Analyze Hough Transform and its applications to detect lines, circles, ellipses • Analyze three-dimensional image analysis techniques • Illustrate motion analysis • Discuss some applications of computer vision algorithms 			

Module -1	Teaching Hours
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	8 Hours
Module -2	
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	8 Hours
Module – 3	
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	8 Hours
Module-4	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	8 Hours
Module-5	
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	8 Hours
Course outcomes:	
Upon completion of the course, the students will be able to	
<ul style="list-style-type: none"> • Implement fundamental image processing techniques required for computer vision • Perform shape analysis • Implement boundary tracking techniques • Apply chain codes and other region descriptors • Apply Hough Transform for line, circle, and ellipse detections. • Apply 3D vision techniques. • Implement motion related techniques. • Develop applications using computer vision techniques. 	
Question paper pattern:	
The question paper will have ten questions.	
There will be 2 questions from each module.	
Each question will have questions covering all the topics under a module.	
The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning	

(Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

BUSINESS INTELLIGENCE AND ITS APPLICATIONS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER - IV

Subject Code	16SIT421 / 16SCS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS - 03

Course objectives: This course will enable students to

- Evaluate the key elements of a successful business intelligence (BI) program
- Apply a BI meta model that turns outcomes into actions
- Extract and transform data from an operational data to a data business data
- Evaluate business analytics and performance measurement tools

Module -1

Teaching Hours

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

8 Hours

Module -2

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

8 Hours

Module – 3

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

8 Hours

Module-4

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

8 Hours

Module-5

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.

8 Hours

Course outcomes:

Upon completion of the course, the students will be able to

- Explain the complete life cycle of BI/Analytical development
- Illustrate technology and processes associated with Business Intelligence framework
- Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

<p>Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003. 2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4. 2. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006. 3. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

<p>AGILE TECHNOLOGIES [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV</p>			
Subject Code	16SCS423 /16SSE423	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain iterative, incremental development process leads to faster delivery of more useful software • Evaluate essence of agile development methods • Illustrate the principles and practices of extreme programming • Show the roles of prototyping in the software process • Explain the Mastering Agility 			
Module -1			Teaching Hours
<p>Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor</p>			8 Hours
Module -2			
<p>Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility</p>			8 Hours
Module – 3			

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: “Done Done”, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing	8 Hours
Module-4	
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People : Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste : Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	8 Hours
Module-5	
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence : Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	8 Hours
Course outcomes:	
Students should be able to <ul style="list-style-type: none"> • Define XP Lifecycle, XP Concepts, Adopting XP • Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests • Demonstrate concepts to Eliminate Waste 	
Question paper pattern:	
The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books:	
1. The Art of Agile Development (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007	
Reference Books:	
1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002 2. Agile and Iterative Development A Manger's Guide”, Craig Larman Pearson Education, First Edition, India, 2004	

WIRELESS NETWORKS AND MOBILE COMPUTING

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	16SCE22 / 16SCS424	IA Marks	20
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Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Define concepts of wireless communication. • Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication. • Explain CDMA, GSM. Mobile IP, Wimax and Different Mobile OS • Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns 			
Module -1			Teaching Hours
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.			8 Hours
Module -2			
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6			8 Hours
Module – 3			
Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators			8 Hours
Module-4			
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.			8 Hours
Module-5			
J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.			8 Hours
Course outcomes:			
The students shall able to:			
<ul style="list-style-type: none"> • Explain state of art techniques in wireless communication. • Discover CDMA, GSM. Mobile IP, Wimax • Demonstrate program for CLDC, MIDP let model and security concerns 			
Question paper pattern:			
The question paper will have ten questions.			
There will be 2 questions from each module.			
Each question will have questions covering all the topics under a module.			
The students will have to answer 5 full questions, selecting one full question from each module.			

Text Books:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT SYSTEM
(CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech. (Computer Science & Engineering)

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16SCS21	Managing Big Data	4	--	3	20	80	100	4
16SCS22	Advances in Computer Networks	4	--	3	20	80	100	4
16SCS23	Advanced Algorithms	4	--	3	20	80	100	4
16SCS24	Internet of Things	4	--	3	20	80	100	4
16SCS25x	Course Elective - II	4	--	3	20	80	100	3
16SCS26	Mini-project	--	3 hrs lab	3	20	80	100	2
16SCS27	Seminar	--	--	--	100	--	100	1
Total		20	3	18	220	480	700	22

Course Elective II	
16SCS253	Information and Network Security

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM CHOICE BASED CREDIT
SYSTEM (CBCS) SCHEME OF TEACHING AND EXAMINATION 2016-2017**

M. Tech. (Computer Science & Engineering)

III SEMESTER: Internship

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16SCS32	Report on Internship	-	-	-	25	-	25	
3	16SCS33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16SCS34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME OF TEACHING
AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

IV SEMESTER

CREDIT BASED

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16SCS41	Machine Learning Techniques	4	-	3	20	80	100	4
2	16SCS42x	Course Elective-III	3	-	3	20	80	100	3
3	16SCS43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16SCS44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			7	-	6	90	360	450	20

Elective

16SCS423 Agile Technologies

Note:

1. **Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.
2. **Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
3. **Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
4. **Project evaluation:**
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCS11	Advances in Operating Systems	4	--	03	50	100	150	4
14SCS12	Cloud Computing	4	2 *	03	50	100	150	4
14SCS13	Advances in Data Base Management System	4	2 *	03	50	100	150	4
14SCS14	Multi Core Architecture and Programming	4	2	03	50	100	150	4
14SCS15x	Elective – I	4	2	03	50	100	150	4
14SCS16	Advances in Operating Systems Laboratory	0	3	03	25	50	75	2
14SCS17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I:

14SCS152 Advances in Storage Area Networks

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS21	Managing Big Data	4	2 *	03	50	100	150	4
14SCS22	Advances in Computer Networks	4	2 *	03	50	100	150	4
14SCS23	Advanced Algorithms	4	--	03	50	100	150	4
14SCS24	Artificial Intelligence and Agent Technology	4	2	03	50	100	150	44
14SCS25x	Elective – II	4	2	03	50	100	150	4
14SCS26	Advanced Algorithms Laboratory	0	3	03	25	50	75	2
14SCS27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCS252 Information and Network Security

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork		I.A.	Exam		
14SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *	--	--	--	25	--	25	1
14SCS32	Report on Internship **	--	--	--	--	75	75	15
14SCS33	Evaluation and Viva-voce	--	--	3	--	50	50	4
Total		--	--	3	25	125	150	20

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH(COMPUTER SCIENCE and ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching					Total Marks	CREDITS
		hours/week		Duration of Exam in Hours	Marks for			
		Lecture	Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS41	Machine Learning Techniques	4	2 *	03	50	100	150	4
14SCS42x	Elective-III	4	2	03	50	100	150	4
14SCS43	Evaluation of Project Phase-II	0	--	0	25	--	25	1
14SCS44	Evaluation of Project Phase-III	0	--	0	25	--	25	1
14SCS45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	200	18
Total		08	07	09	150	400	550	28
Grand Total (I to IV Sem.)			Marks: 2400 ;		Credits : 94			

Elective – III

14SCS423 Agile Technologies

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1).Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase = III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 (50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce).

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Semester: I

Year: 2014-2015

Course Title: Advances In Operating Systems	Course Code: 14SCS11
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating Systems.

TOPICS:

MODULE I

Operating System Overview, Process description & control

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management.

10 Hours

Module II

Threads, SMP, and Microkernel, Virtual Memory.

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Windows Vista Thread and SMP Management, Solaris Thread and SMP Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.

10 Hours

Module III

Multiprocessor and Real-Time Scheduling

Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

10 Hours

Module IV

Embedded Operating Systems

Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

10 Hours

MODULEV

Kernel Organization

Using Kernel Services, Daemons, Starting the Kernel , Control in the Machine , Modules and Device Management, MODULEOrganization, MODULEInstallation and Removal, Process and Resource Management, Running Process

Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management.

The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager, The cache Manager , Kernel local procedure calls and IPC, The native API, subsystems.

10 Hours

Course Outcomes:

The students should be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Semester: I

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCS12
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.

Topics:

Module I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

Module II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

Module III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

Module IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

Module V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment (**Eg; Amazon cloud**) and **VM ware for resource virtualization.**

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a *web-hosting application service*, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for

a. Strassen's Matrix Multiplication for a huge matrix.

b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on

the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor

with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must re compute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:

The students should be able to:

- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Course Title: Advances in Database Management Systems	Course Code: 14SCS13
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented database
- To understand the basic concepts, principles of intelligent databases.
- To understand the advanced topics of data warehousing and mining .
- To learn emerging and advanced data models
- To acquire inquisitive attitude towards research topics in databases.

Topics:**MODULE I**

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II

Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition language, ODL, Object Query Language, OQL, Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of: SQL, Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV

Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

10 Hours

LABORATORY WORK:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.
2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.
3. Design and develop a suitable Student Database application. One of the attributes to be maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:
 - a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.
 - b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.
4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Course Title: Multi-Core Architecture and Programming	Course Code: 14SCS14
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:**MODULE I**

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **10 Hours**

Module II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours**MODULE III**

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours**MODULE IV**

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared

Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

Course Outcomes:

The students should be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Semester: I

Year: 2014-2015

Course Title: Advances in Digital Image Processing	Course Code: 14SCS151
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:

MODULE I

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

10 Hours

MODULE II

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

10 Hours

MODULE III

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

10 Hours

MODULE IV

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **Wavelets and Multiresolution Processing:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image Compression:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

10 Hours

MODULE V:

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

10 Hours

Course Outcomes:

The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image
- Apply algorithms in practical applications.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005

REFERENCES:

- 1.A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
- 2.Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Semester: I

Year: 2014-2015

Course Title: Advances in Storage Area Networks	Course Code: 14SCS152
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS:** Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management,

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept,
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

Downloaded from A-ZShiksha.com

Course Title: Embedded Computing Systems	Course Code: 14SCS153
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COUR
SE**OBJECTIVES**

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:**MODULE I**

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

7 Hours**MODULE II**

Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours**MODULE III**

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours**MODULE IV**

Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

10 Hours**MODULE V**

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. **Introduction to embedded**

software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:

The students should be able to:

- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:

1. **Raj Kamal**, “Embedded Systems: Architecture, Programming, and Design” 2nd edition , Tata McGraw hill-2013

Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

2. **Marilyn Wolf** ,“Computer as Components, Principles of Embedded Computing System Design” 3rd edition , Elsevier-2014 .

Course Title: Advances in Computer Graphics	Course Code: 14SCS154
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:**MODULE I**

Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bazier Surfaces B-Spline Curves, B-Spline Surfaces, Beta- Splines, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and rfaces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours**MODULE II**

Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions.

10 Hours**MODULE III**

Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping, OpenGL Illumination and surface-rendering functions, openGL texture functions.

10 Hours**MODULE IV**

Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications. Raster methods for computer animation, Design of animations sequences, Traditional animation techniques,

General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V

Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using OpenGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:

The students are able to :

- Represent and implement images and objects using 3D representation and OpenGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:

1. Computer Graphics with OpenGL-Hearn Baker 4rd edition, Pearson publication.2010 (Chapter 8,9,10.12.13.14,15)
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013

Reference Books:

1. Edward Angel: Interactive Computer graphics a top-down approach with OpenGL, Addison Wesley, 6th edition 2012
2. Advanced graphics programming using OpenGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005

Semester: I

Year: 2014-2015

Course Title: Advances in Operating Systems Laboratory	Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/ any equivalent language or tool with suitable platform.

1. Design and Develop a shell that should support at least 20 commands.
2. Design and develop a program to implement lazy buddy system algorithm.
3. Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
5. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:

- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Course Title: Managing Big Data	Course Code: 14SCS21
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:**MODULE I**

UNDERSTANDING BIG DATA 10 Hours What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

MODULE II

NOSQL DATA MANAGEMENT 10 Hours Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – version – MapReduce – partitioning and combining – composing map-reduce calculations

MODULE III**BASICS OF HADOOP****10 Hours**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

MODULE IV

MAPREDUCE APPLICATIONS 10 Hours MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V

HADOOP RELATED TOOLS 10 Hours Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LAB Experiments**Exercise 1 --- HDFS**

Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the `hadoop fs` command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file `foo.txt` from local disk to the user's directory in HDFS
3. Get a directory listing of the user's home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file `user/fred/bar.txt`
6. Move that file to the local disk, named as `baz.txt`
7. Create a directory called `input` under the user's home directory
8. Delete the directory `input` and all its contents
9. Verify the copy by listing the directory contents in HDFS:

Exercise 2 --- MapReduce

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

Exercise 3 --- MapReduce (Programs)

Using movie lens data

1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

Exercise4 – Extract facts using Hive

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The `moveapp_log_json` table contains an activity column. Activity states are as follows:

1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE

```

hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json (
custId INT,
movieId INT,
genreId INT,
time STRING,
recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json

```

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.

2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.

3. Load the results of the previous two queries into a staging table. First, create the staging table:

4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce

tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.
2. Group the log sample by movie and dump the resulting bag.

3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

Course Outcomes:

The students should be able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.

REFERENCES:

1. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
4. Alan Gates, "Programming Pig", O'Reilly, 2011.

Course Title: Advances in Computer Networks	Course Code: 14SCS22
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To become familiar with the basics of Computer Networks
- To understand various Network architectures
- Concepts of fundamental protocols
- To understand the network traffic, congestion, controlling and resource allocation.

Topics:

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

T1: Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2: Chapter 4 10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagram’s, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2, 10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP
Chapter 3.3, 4.1.1,4.1.3 **T2:**Chapter 13.1 to 13.18 , Ch 18. **T1:**

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP) .

T1: Chapter 6.4 T2: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 10 Hours

Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

References:

1. **Uyless Black** "Computer Networks, Protocols , Standards and Interfaces" 2nd Edition - PHI
2. **Behrouz A Forouzan** "TCP/IP Protocol Suite" 4th Edition – Tata McGraw-Hill

Course Title: Advanced Algorithms	Course Code: 14SCS23
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:**MODULE I**

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours**MODULE II**

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours**MODULE III**

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours**MODULE IV**

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours**MODULE V**

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Semester: II

Year: 2014-2015

Course Title: Artificial Intelligence and Agent Technology	Course Code: 14SCS24
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Apply a given AI technique to a given concrete problem
- To Implement non-trivial AI techniques in a relatively large system
- To understand uncertainty and Problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

TOPICS:

MODULE I

What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.

Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems. **Intelligent Agents:** Agents and Environments, The nature of environments, The structure of agents.

Text Book 1: Chapter 1 & 2

Text Book 2: Chapter 2

10 Hours

MODULE II

Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.

Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6

10 Hours

MODULE III

Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.

Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited.

Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13

10Hours

MODULE IV

Weak Slot-and-filter structures: Semantic Nets, Frames.

Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches, Summary

Text Book 1: Chapter 9 & 10 Text Book 2: Chapter 5

10 Hours

MODULE V

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Text Book 2: Chapter 18 & 20

10 Hours

COURSE OUTCOMES:

The students are able to:

- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.
- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

Text Books.

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books:

3. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

Semester: II

Year: 2014-2015

Course Title: Web Services	Course Code: 14SCS251
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course objectives:

- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

TOPICS:

MODULE I

Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **10 Hours**

MODULE II

Web Services: Web Services Technologies, Web Services Architecture. **10 Hours**

MODULE III

Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards. **10 Hours**

MODULE IV

Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **10 Hours**

MODULE V

Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example. **10 Hours**

Course Outcomes:

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Course Title: Information And Network Security	Course Code: 14SCS252
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:**MODULE I****Classical Encryption Techniques**

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours**MODULE II**

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems, public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Z_p , elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours**MODULE III**

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours**MODULE IV**

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, . **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic

Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.

10 Hours

Course Outcomes:

The students be able to

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

References

1. V k Pachghare: Cryptography and Information Security, PHE ,2013.

Semester: II

Year: 2014-2015

Course Title : Pattern Recognition	Course Code: 14SCS253
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems.

10 Hours

MODULE II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation.

10 Hours

MODULE III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network.

10 Hours

MODULE IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples.

10 Hours

MODULE V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples.

10 Hours

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Develop and analyze decision trees.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

References

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

Course Title: Optical Networks	Course Code: 14SCS254
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors -
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:**MODULE I**

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours**MODULE II****WDM Network Elements**

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours**MODULE III****Control and Management**

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours**MODULE IV****Basic Concepts, Protection in SONET/SDH:**

Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1: N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design:

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES:

The students will be able to:

- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyles Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advanced Algorithms Laboratory	Course Code: 14SCS26
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/language by adapting exception handling technique wherever it is suitable.

1. Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2. Design, develop, and write a program to implement a Monte Carlo algorithm to test the **primality** of a given integer and determine its performance.
3. Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4. Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.
5. Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Course Outcomes:

Upon completion of the course, the students will be able to

- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Course Title: Machine Learning Techniques	Course Code: 14SCS41
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

TOPICS:**MODULE I****INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **10 Hrs**

MODULE II**NEURAL NETWORKS AND GENETIC ALGORITHMS**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **10 Hrs**

MODULE III**BAYESIAN AND COMPUTATIONAL LEARNING**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **10 Hrs**

MODULE IV**INSTANT BASED LEARNING AND LEARNING SET OF RULES**

K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **10 Hrs**

MODULE V**ANALYTICAL LEARNING AND REINFORCED LEARNING**

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **10 Hrs**

LABORATORY WORK

(The following tasks can be implemented in a language of your choice or any tools available)

- 1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
- 2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.

- 3) Implement the ID3 algorithm for learning Boolean-valued functions for classifying the training examples by searching through the space of a Decision Tree.
- 4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
- 5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

REFERENCES:

2. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Course Title: Computer Vision	Course Code: 14SCS421
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:**MODULE I**

CAMERAS: Pinhole Cameras, **Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

10 Hours**MODULE II**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

10 Hours**MODULE III**

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

10 Hours**MODULE IV**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

10 Hours**MODULE V**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, **Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into

Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model- Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **10 Hours**

Course Outcomes:

Upon completion of the course, the students will be able to

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

4. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Course Title: Business Intelligence And Its Applications	Course Code: 14SCS422
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:**MODULE I**

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

10 Hours**MODULE II**

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours**MODULE III**

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours**MODULE IV**

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

10 Hours**MODULE V**

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.

10 Hours**Course Outcomes:**

Upon completion of the course, the students will be able to

- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework

- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

3. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
4. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
5. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

Semester: IV

Year: 2014-2015

Course Title: Agile Technologies	Course Code: 14SCS423
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **10 Hours**

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **10 Hours**

MODULE III

Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

10 Hours

MODULE IV

Mastering Agility

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence** :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

COURSE OUTCOMES

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002
- 2., "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

Course Title: Wireless Networks And Mobile Computing	Course Code: 14SCS424
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To understand CDMA, GSM, Mobile IP, Wimax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Wireless Networks :** Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

10 Hours

MODULE II

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

10 Hours

MODULE III

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours

MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:

The student should be able to:

- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDP let model and security concerns

TEXT BOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

**Common to Design Engineering (MDE), Engineering Analysis & Design
(MEA),Machine Design (MMD)**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. Machine Design

I SEMESTER

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16 MDE11	Applied Mathematics	4	2	3	20	80	100	4
16 MDE12	Finite Element Method	4	2	3	20	80	100	4
16CAE13	Continuum Mechanics	4	2	3	20	80	100	4
16CAE16	Experimental Mechanics	4	2	3	20	80	100	4
	Elective – I	4	2	3	20	80	100	4
16MDE16	Design Engineering Lab I	--	3	3	20	80	100	2
16MMD17	SEMINAR	--	-	--	100	--	100	1
Total		20	13	18	220	480	700	23

ELECTIVE-I

16MDE 151	Computer Graphics	16 MDE 153	Mechatronics System Design
16MDE 152	Computer Applications in Design	16MDE 154	Design for Manufacture
16MEA155	Advanced Fluid Dynamics		

APPLIED MATHEMATICS

(Common to MDE,MMD,MEA,CAE,MCM,MAR,IAE,MTP,MTH,MTE,MST,MTR)

Sub Code : 16MDE11 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objectives:

The main objectives of the course are to enhance the knowledge of various methods in finding the roots of an algebraic, transcendental or simultaneous system of equations and also to evaluate integrals numerically and differentiation of complex functions with a greater accuracy. These concepts occur frequently in their subjects like finite element method and other design application oriented subjects.

Course Content:

1. Approximations and round off errors: Significant figures, accuracy and precision, error definitions, round off errors and truncation errors. Mathematical modeling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering.**06 Hours**
2. Roots of Equations: Bracketing methods-Graphical method, Bisection method, False position method, Newton- Raphson method, Secant Method. Multiple roots, Simple fixed point iteration. Roots of polynomial-Polynomials in Engineering and Science, Muller's method, Bairstow's Method Graeffe's Roots Squaring Method.**12 Hours**
3. Numerical Differentiation and Numerical Integration: Newton –Cotes and Gauss Quadrature Integration formulae, Integration of Equations, Romberg integration, Numerical Differentiation Applied to Engineering problems, High Accuracy differentiation formulae**06 Hours**
4. System of Linear Algebraic Equations And Eigen Value Problems: Introduction, Direct methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization method, Cholesky Method, Partition method, error Analysis for direct methods, Iteration Methods.

Eigen values and Eigen Vectors: Bounds on Eigen Values, Jacobi method for symmetric matrices, Givens method for symmetric matrices, Householder's method for symmetric matrices, Rutishauser method for arbitrary matrices, Power method, Inverse power method .**16 Hours**

5. Linear Transformation: Introduction to Linear Transformation, The matrix of Linear Transformation, Linear Models in Science and Engineering
Orthogonality and Least Squares: Inner product, length and orthogonality, orthogonal sets, Orthogonal projections, The Gram-schmidt process, Least Square problems, Inner product spaces. **12 Hours**

Text Books:

1. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI, 2005.
2. Steven C. Chapra, Raymond P.Canale, Numerical Methods for Engineers, Tata Mcgraw Hill, 4th Ed, 2002.
3. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engg computation, New Age International, 2003.

Reference Books:

1. Pervez Moin, Fundamentals of Engineering Numerical Analysis, Cambridge, 2010.
2. David. C. Lay, Linear Algebra and its applications, 3rd edition, Pearson Education, 2002.

Course Outcomes:

The Student will be able to

1. Model some simple mathematical models of physical Applications.
2. Find the roots of polynomials in Science and Engineering problems.
3. Differentiate and integrate a function for a given set of tabulated data, for Engineering Applications

FINITE ELEMENT METHOD
(Common to MDE,MEA,MMD,CAE,MTR)

Sub Code : 16MDE12 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objectives

1. To present the Finite element method (FEM) as a numerical method for engineering analysis of continua and structures
2. To present Finite element formulation using variational and weighted residual approaches
3. To present Finite elements for the analysis of bars & trusses, beams & frames, plane stress & plane strain problems and 3-D solids, for thermal and dynamics problems.

Course Content:

1. **Introduction to Finite Element Method:** Basic Steps in Finite Element Method to solve mechanical engineering (Solid, Fluid and Heat Transfer) problems: Functional approach and Galerkin approach, Displacement Approach: Admissible Functions, Convergence Criteria: Conforming and Non Conforming elements, C_0 , C_1 and C_n Continuity Elements. Basic Equations, Element Characteristic Equations, Assembly Procedure, Boundary and Constraint Conditions.

10 Hours.
2. **Solid Mechanics : One-Dimensional Finite Element Formulations and Analysis** – Bars- uniform, varying and stepped cross section- Basic(Linear) and Higher Order Elements Formulations for Axial, Torsional and Temperature Loads with problems. Beams- Basic (Linear) Element Formulation-for uniform, varying and stepped cross section- for different loading and boundary conditions with problems. Trusses, Plane Frames and Space Frame Basic(Linear) Elements Formulations for different boundary condition -Axial, Bending, Torsional, and Temperature Loads with problems.

10 Hours.

3. **Two Dimensional Finite Element Formulations for Solid Mechanics Problems:** Triangular Membrane (TRIA 3, TRIA 6, TRIA 10) Element, Four-Noded Quadrilateral Membrane (QUAD 4, QUAD 8) Element Formulations for in-plane loading with sample problems. Triangular and Quadrilateral Axi-symmetric basic and higher order Elements formulation for axi-symmetric loading only with sample problems
Three Dimensional Finite Element Formulations for Solid Mechanics Problems: Finite Element Formulation of Tetrahedral Element (TET 4, TET 10), Hexahedral Element (HEXA 8, HEXA 20), for different loading conditions. Serendipity and Lagrange family Elements

10 Hours.

4. **Finite Element Formulations for Structural Mechanics Problems:** Basics of plates and shell theories: Classical thin plate Theory, Shear deformation Theory and Thick Plate theory. Finite Element Formulations for triangular and quadrilateral Plate elements. Finite element formulation of flat, curved, cylindrical and conical Shell elements
5. **Dynamic Analysis:** Finite Element Formulation for point/lumped mass and distributed masses system, Finite Element Formulation of one dimensional dynamic analysis: bar, truss, frame and beam element. Finite Element Formulation of Two dimensional dynamic analysis: triangular membrane and axisymmetric element, quadrilateral membrane and axisymmetric element. Evaluation of eigen values and eigen vectors applicable to bars, shaft, beams, plane and space frame.

10 Hours.

Text Books:

1. T. R. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall, 3rd Ed, 2002.
2. Lakshminarayana H. V., Finite Elements Analysis– Procedures in Engineering, Universities Press, 2004.

Reference Books:

1. Rao S. S. , Finite Elements Method in Engineering- 4th Edition, Elsevier, 2006
2. P.Seshu, Textbook of Finite Element Analysis, PHI, 2004.
3. J.N.Reddy, Introduction to Finite Element Method, McGraw -Hill, 2006.
4. Bathe K. J., Finite Element Procedures, Prentice-Hall, 2006..
5. Cook R. D., Finite Element Modeling for Stress Analysis, Wiley,1995.

Course Outcome:

On completion of the course the student will be

1. Knowledgeable about the FEM as a numerical method for the solution of solid mechanics, structural mechanics and thermal problems
2. Developing skills required to use a commercial FEA software

CONTINUUM MECHANICS
(Common to MDE, MEA, MMD, CAE)

Sub Code: 14CAE13
Hrs/ Week: 04
Total Hrs: 50

IA Marks: 20
Exam Hours: 03
Exam Marks: 80

Course Objective:

The course Continuum Mechanics aims at a comprehensive study of Mechanics of Solids and Mechanics of Fluids. The topics covered are: Analysis of Stress, Deformation and Strain, Generalized Hooke's law, Formulation of Two Dimensional Electrostatic problems, Basic equations of Viscoelasticity.

Course Content:

1. Analysis of Stress: Definition and Notation for forces and stresses. body force, surface force Components of stresses, equations of Equilibrium, Specification of stress at a point. Principal stresses, maximum and minimum shear stress, Mohr's diagram in three dimensions. Boundary conditions .Stress components on an arbitrary plane, Stress invariants, Octahedral stresses, Decomposition of state of stress, deviator and spherical stress tensors, Stress transformation. 10 Hours

2. Deformation and Strain: Deformation, Strain Displacement relations, Strain components, The state of strain at a point, , Principal strain, strain invariants, Strain transformation, Compatibility equations, Cubical dilatation, spherical and deviator strains, plane strain, Mohr's circle, and compatibility equation

Relations and the General Equations of Elasticity: Generalized Hooke's; law in terms of engineering constants. Formulation of elasticity Problems. 12 Hours

3. Two Dimensional Problems in Cartesian Co-Ordinates: Airy's stress function, investigation of simple beam problems. Bending of a narrow cantilever beam under end load, simply supported beam with uniform load, Use of Fourier series to solve two dimensional problems. Existence and uniqueness of solution, Saint -Venant's principle, Principle of super position and reciprocal theorem. 9 Hours.

4. Two Dimensional Problems in Polar Co-Ordinates: General equations, stress distribution symmetrical about an axis, Strain components in polar co-ordinates, Rotating disk and cylinder, Concentrated force on semi-infinite plane, Stress concentration around a circular hole in an infinite plate.

Thermal Stresses: Introduction, Thermo-elastic stress -strain relations, thin circular disc, long circular cylinder. 9 Hours

5 Torsion of Prismatic Bars: Introduction, Torsion of Circular cross section bars, Torsion of elliptical cross section bars, Soap film analogy, Membrane analogy, Torsion of thin walled open tubes.

Elastic Stability: Axial compression of prismatic bars, Elastic stability, buckling load for column with constant cross section. **Viscoelasticity:** Linear viscoelastic behavior. Simple viscoelastic models-generalized models, linear differential operator equation. Creep and Relaxation- creep function, relaxation function, hereditary integrals. Complex moduli and compliances. (Note: No numerical) 10 Hours

Text Books:

1. Timoshenko and Goodier, "**Theory of Elasticity**"-'Tata McGraw Hill, New Delhi,3rd edition , 1970
2. L S Srinath "Advanced Mechanics of Solids"- Tata McGraw Hill, New Delhi, 3rd edition, 2010
3. G. Thomas Mase, Ronald E. Smelser, George. E. Mase, Continuum Mechanics for Engineers, 3rd Edition, CRC Press,Boca Raton, 2010

References:

1. Batra, R. C., Elements of Continuum Mechanics, Reston, 2006.
2. George E. Mase, Schaum's Outline of Continuum Mechanics, McGraw-Hill, 1970
3. Dill, Ellis Harold, Continuum Mechanics: Elasticity, Plasticity, Viscoelasticity, CRC Press , 2006.
4. Sadhu Singh, " Theory of Elasticity"- Khanna publisher, 4th edition, 2013

Course Outcome:

Continuum Mechanics background essential to mathematically model physical problems in Solid Mechanics

EXPERIMENTAL MECHANICS

(Common to MDE,MEA,MMD,CAE)

Sub Code : 16CAE16 IA Marks :20

Hrs/ Week : 04 Exam Hours : 03

Total Hrs: 50 Exam Marks :80

Course Objective:

This course aims at a comprehensive study of mechanics of solids. The topics covered are

The objective of this course is to familiarize the student with state of the art experimental techniques namely strain gauges, photo elasticity, moiré interferometry, brittle coating, moiré fringes and holography.

Course Content:

1. **Introduction:** Definition of terms, calibration, standards, dimension and units, generalized measurement system, Basic concepts in dynamic measurements, system response, distortion, impedance matching, experiment planning.

Analysis of Experimental Data: Cause and types of experimental errors, error analysis. Statistical analysis of experimental data- Probability distribution, gaussian, normal distribution. Chi-square test, Method of least square, correlation coefficient, multivariable regression, standard deviation of mean, graphical analysis and curve fitting, general consideration in data analysis.

10 Hours

2. **Data Acquisition and Processing:** General data acquisition system, signal conditioning revisited, data transmission, Analog-to-Digital and Digital-to- Analog conversion, Basic components (storage and display) of data acquisition system. Computer program as a substitute for wired logic.

Force, Torque and Strain Measurement: Mass balance measurement, Elastic Element for force measurement, torque measurement. Strain Gages -Strain sensitivity of gage metals, Gage construction, Gage sensitivity and gage factor, Performance characteristics, Environmental effects Strain, gage circuits, Potentiometer, Wheat Stone's bridges, Constant current circuits. Strain Analysis Methods-Two element and three element, rectangular and delta rosettes, Correction for transverse strains effects, stress gage - plane shear gage, Stress intensity factor gage.

10 Hours

3. **Stress Analysis:** Two Dimensional Photo elasticity - Nature of light, - wave theory of light,- optical interference - Polariscope stress optic law - effect of stressed model in plane and circular Polariscope, Isoclinics Iso chromatics fringe order determination - Fringe multiplication

techniques - Calibration Photoelastic model materials. Separation methods shear difference method, Analytical separation methods, Model to prototype scaling.

10 Hours

4. **Three Dimensional Photo elasticity:** Stress freezing method, General slice, Effective stresses, Stresses separation, Shear difference method, Oblique incidence method Secondary principals stresses, Scattered light photo elasticity, Principals, Polari scope and stress data analyses.

10 Hours

5. **Coating Methods:** a) Photoelastic Coating Method-Birefringence coating techniques Sensitivity Reinforcing and thickness effects - data reduction - Stress separation techniques Photoelastic strain gauges. b) Brittle Coatings Method:Brittle coating technique Principles data analysis - coating materials, Coating techniques. c) Moire Technique - Geometrical approach, Displacement approach- sensitivity of Moire data data reduction, In plane and out plane Moire methods, Moire photography, Moire grid production.

Holography: Introduction, Equation for plane waves and spherical waves, Intensity, Coherence, Spherical radiator as an object (record process), Hurter, Driffeld curves, Reconstruction process, Holographicinterferomerty, Realtime. and double exposure methods, Displacement measurement, Isopachics.

10 Hours

Text Books:

1. **Holman**, "Experimental Methods for Engineers" 7th Edition, Tata McGraw-Hill Companies, Inc, New York, 2007.
2. **R. S. Sirohi, H. C. Radha Krishna**, "Mechanical measurements" New Age International Pvt. Ltd., New Delhi, 2004
3. **Experimental Stress Analysis** - Srinath, Lingaiah, Raghavan, Gargesa, Ramachandra and Pant, Tata McGraw Hill, 1984.
4. **Instrumentation, Measurement And Analysis** -Nakra&Chaudhry, B C Nakra K KChaudhry, Tata McGraw-Hill Companies, Inc, New York, Seventh Edition, 2006.

Reference Books:

1. **Measurement Systems Application and Design** - Doebelin E. A., 4th (S.I.) Edition, McGraw Hill, New York. 1989
2. **Design and Analysis of Experiments** - Montgomery D.C., John Wiley & Sons, 1997.
3. **Experimental Stress Analysis** - Dally and Riley, McGraw Hill, 1991.
4. **Experimental Stress Analysis** - Sadhu Singh, Khanna publisher, 1990.
5. **PhotoelasticityVol I and Vol II** - M.M.Frocht,. John Wiley and sons, 1969.
6. **Strain Gauge Primer** - Perry and Lissner, McGraw Hill, 1962.

Course Outcome:It helps the students to

1. Undertake experimental investigations to verify predictions by other methods.
2. To acquire skills for experimental investigations an accompanying laboratory course is desirable.

Elective-I

COMPUTER GRAPHICS

(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE151 IA Marks :20

Hrs/ Week : 04 Exam Hours : 03

Total Hrs: 50 Exam Marks :80

Course Objective:

This course will help the student to be knowledgeable of concepts, principles, processes and techniques essential to all areas of computer graphics

Course Content:

1. Transformations : Representation of points, Transformations: Rotation, Reflection, Scaling, Shearing, Combined Transformations, Translations and Homogeneous Coordinates, A geometric interpretation of homogeneous coordinates, Over all scaling, Points at infinity, Rotation about an arbitrary point, Reflection through an arbitrary line, Rotation about an axis parallel to coordinate axis, Rotation about an arbitrary axis in space, Reflection through an arbitrary plane.

10 Hours

2. Types and Mathematical Representation of Curves: Curve representation, Explicit, Implicit and parametric representation. Nonparametric and parametric representation of Lines, Circles, Ellipse, Parabola, Hyperbola, Conics. Parametric representation of synthetic curve, Hermite cubic splines, , Bezier curves: Blending function, Properties, generation, B-spline curves- Cox-deBoor recursive formula, Properties, Open uniform basis functions, Non-uniform basis functions, Periodic B-spline curve.

Types and Mathematical Representation of Surfaces Surface entities and parametric representation- Plane, Ruled, surface of revolution, Offset surface, Coons patch, Bezier surface, B-spline surface

10Hours

3. Types and Mathematical Representation of Solids

Solid entities: Block, Cylinder, Cone, Sphere, Wedge, Torus, Solid representation, Fundamentals of solid modeling, Set theory, Regularized set operations, Set membership classification, Half spaces, Basic elements, Building operations, Boundary representation and Constructive solid geometry, Basic elements, Building operations.

Scan Conversion and Clipping: Representation of points, lines, Drawing Algorithms: DDA algorithm, Bresenham's integer line algorithm, Bresenham's circle algorithm, Polygon filling algorithms: Scan conversion, Seed filling, Scan line algorithm. Viewing transformation, Clipping - Points, lines, Text, Polygon, Cohen-Sutherland line clipping, Sutherland-Hodgmen algorithm.

10Hours

4. Visual Realism: Introduction, Hidden line removal, Visibility of object views, Visibility techniques: Minimax test, Containment test, Surface test, Silhouettes, Homogeneity test, Sorting, Coherence, Hidden surface removal- Z-buffer algorithm, Warnock's algorithm, Hidden solid removal - ray tracing algorithm, Shading, Shading models, Diffuse reflection, Specular reflection, Ambient light, Shading of surfaces: Constant shading, Gourand shading, Phong shading, Shading enhancements, Shading Solids, Ray tracing for CSG, Z-buffer algorithm for B-rep and CSG

10 Hours

5.Applications: Colouring- RGB, CMY, HSV, HSL colour models, Data Exchange: Evolution of Data exchange, IGES, PDES, Animation: Conventional animation-key frame, Inbetweening, Line testing, Painting, Filming, Computer animation, Entertainment and Engineering Animation, Animation system hardware, Software architecture, Animation types, Frame buffer, Colour table, Zoom-pan-scroll, Cross bar, Real time play back, Animation techniques- key frame, Skelton. Path of motion and p-curves.

10 Hours

TextBooks:

1. IbrahimZeid, CAD/CAM-Theory and Practice-McGraw Hill, 2006.
2. David Rogers & Alan Adams, Mathematical Elements for Computer Graphics-Tata McGraw Hill, 2002.

ReferenceBooks:

1. Xiang Z, Plastock, R. A, Computer Graphics- Schaum's Outline, McGraw Hill, 2007.
2. Foley, van Dam, Feiner and Hughes, Computer Graphics- Principles and Practice-Addison Wesley, 1996.
3. Sinha A N., Udai A D., Computer Graphics- Tata McGraw Hill, 2008.

Course Outcome:

This course will enable students to:

1. Recognize how a visual image can be an effective means of communication
2. Acquire and develop the skills needed to creatively solve visual communication problems.
3. Understand, develop and employ visual hierarchy using images and text

COMPUTER APPLICATIONS IN DESIGN
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE152 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective

It helps the students to learn the principles of CAD/CAM/CAE Systems, Graphics Programming, Geometric Modeling Systems, CAD, CAM and CAE Integration, Standards for Communicating between Systems

Course Content:

1. Introduction To CAD/CAM/CAE Systems

Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development-A Practical Example.

Components of CAD/CAM/CAE Systems: Hardware Components ,Vector-Refresh(Stroke-Refresh) Graphics Devices, Raster Graphics Devices, Hardware Configuration, Software Components, Windows-Based CAD Systems.**10 Hours**

2. Basic Concepts of Graphics Programming:

Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painters, Algorithm, Hidden-Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.

Standards

Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies

10 Hours

3. Geometric Modeling Systems

: Wireframe Modeling Systems, Surface Modeling Systems, Solid Modeling Systems, Modeling Functions, Data Structure, Euler Operators, Boolean Operations, Calculation of Volumetric Properties, Non manifold Modeling Systems, Assembly Modeling Capabilities, Basic Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly models, Simplification of Assemblies, Web-Based Modeling.

Representation and Manipulation of Curves: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve

10 Hours

4. B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Non uniform Rational B-Spline (NURBS) Curve, Evaluation of a NURBS Curve, Differentiation of a NURBS Curve, Interpolation Curves, Interpolation Using a Hermite Curve, Interpolation Using a B-Spline Curve, Intersection of Curves.

Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface, Differentiation of a Bezier Surface, B-Spline Surface, Evaluation of a B-Spline Surface, Differentiation of a B-Spline Surface, NURBS Surface, Interpolation Surface, Intersection of Surfaces.

10 Hours

5. **CAD and CAM Integration**

Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.

10 Hours

Text Books:

1. Kunwoo Lee, "Principles of CAD/CAM/CAE systems"-Addison Wesley, 1999
2. Radhakrishnan P., et al., "CAD/CAM/CIM"-New Age International, 2008

Reference Books:

1. Ibrahim Zeid, "CAD/CAM – Theory & Practice", McGraw Hill, 1998
2. Bedworth, Mark Henderson & Philip Wolfe, "Computer Integrated Design and Manufacturing" -McGraw hill inc., 1991.
3. Pro-Engineer, Part modeling Users Guide, 1998

Course Outcome:

Students develop expertise in generation of various curves, surfaces and volumes used in geometric modeling systems.

MECHATRONICS SYSTEM DESIGN
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE153 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective

1. To educate the student regarding integration of mechanical, electronics, electrical and computer systems in the design of CNC machine tools, Robots etc.
2. To provide students with an understanding of the Mechatronic Design Process, actuators, Sensors, transducers, Signal Conditioning, MEMS and Microsystems and also the Advanced Applications in Mechatronics.

Course Content:

1. Introduction: Definition and Introduction to Mechatronic Systems. Modeling & Simulation of Physical systems Overview of Mechatronic Products and their functioning, measurement systems. Control Systems, simple Controllers. Study of Sensors and Transducers: Pneumatic and Hydraulic Systems, Mechanical Actuation System, Electrical Actual Systems, Real time interfacing and Hardware components for Mechatronics. **10 Hours**
2. Electrical Actuation Systems: Electrical systems, Mechanical switches, Solid state switches, solenoids, DC & AC motors, Stepper motors. System Models: Mathematical models:- mechanical system building blocks, electrical system building blocks, thermal system building blocks, electromechanical systems, hydro-mechanical systems, pneumatic systems. **11 Hours**
3. Signal Conditioning: Signal conditioning, the operational amplifier, Protection, Filtering, Wheatstone Bridge, Digital signals , Multiplexers, Data Acquisition, Introduction to digital system processing, pulse-modulation. MEMS and Microsystems: Introduction, Working Principle, Materials for MEMS and Microsystems, Micro System fabrication process, Overview of Micro Manufacturing, Micro system Design, and Micro system Packaging. **13 Hours**
4. Data Presentation Systems: Basic System Models, System Models, Dynamic Responses of System. **8 Hours**
5. Advanced Applications in Mechatronics: Fault Finding, Design, Arrangements and Practical Case Studies, Design for manufacturing, User-friendly design. **8 Hours**

Text Books:

1. W. Bolton, "Mechatronics" - Addison Wesley Longman Publication, 1999
2. HSU "MEMS and Microsystems design and manufacture"- Tata McGraw-Hill Education, 2002

Reference Books:

1. Kamm, "Understanding Electro-Mechanical Engineering an Introduction to Mechatronics"- IEEE Press, 1 edition ,1996
2. Shetty and Kolk "Mechatronics System Design"- Cengage Learning, 2010
3. Mahalik "Mechatronics"- Tata McGraw-Hill Education, 2003
4. HMT "Mechatronics"- Tata McGraw-Hill Education, 1998
5. Michel .B. Histan& David. Alciatore, "Introduction to Mechatronics & Measurement Systems"- Mc Grew Hill, 2002
6. "Fine Mechanics and Precision Instruments"- Pergamon Press, 1971.

Course Outcome:

This course makes the student to appreciate multi disciplinary nature of modern engineering systems. Specifically mechanical engineering students to collaborate with Electrical, Electronics, Instrumentation and Computer Engineering disciplines.

DESIGN FOR MANUFACTURE
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE154 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective:

To educate students a clear understanding of factors to be considered in designing parts and components with focus on manufacturability

Course Content:

1. Effect of Materials And Manufacturing Process On Design: Major phases of design. Effect of material properties on design Effect of manufacturing processes on design. Material selection process- cost per unit property, Weighted properties and limits on properties methods.

Tolerance Analysis: Process capability, mean, variance, skewness, kurtosis, Process capability metrics, Cp, Cpk, Cost aspects, Feature tolerances, Geometries tolerances, Geometric tolerances, Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerance- Sure fit law and truncated normal law. **12**

Hours

2. Selective Assembly: Interchangeable part manufacture and selective assembly, Deciding the number of groups -Model-1 : Group tolerance of mating parts equal, Model total and group tolerances of shaft equal. Control of axial play-Introducing secondary machining operations, Laminated shims, examples.

Datum Features : Functional datum, Datum for manufacturing, Changing the datum. Examples.**12 Hours**

3. Design Considerations: Design of components with casting consideration. Pattern,Mould, and Parting line. Cored holes and Machined holes. Identifying the possible and probable parting line. Casting requiring special sand cores. Designing to obviate sand cores.

Component Design: Component design with machining considerations link design for turning components-milling, Drilling and other related processes including finish- machining operations. **13 Hours**

4. True positional theory : Comparison between co-ordinate and convention method of feature location. Tolerance and true position tolerancing virtual size concept, Floating and fixed fasteners. Projected tolerance zone. Assembly with gasket, zero position tolerance. Functional gauges, Paper layout gauging. **7 Hours**
5. Design of Gauges: Design of gauges for checking components in assemble with emphasis on various types of limit gauges for both hole and shaft. **6 Hours**

Text Books:

1. Harry Peck , “Designing for Manufacturing”, Pitman Publications, 1983.
2. Dieter , “Machine Design” - McGraw-Hill Higher Education, -2008
3. R.K. Jain, "Engineering Metrology", Khanna Publishers, 1986
4. Product design for manufacture and assembly - Geoffrey Boothroyd, Peter dewhurst, Winston Knight, Marceldekker. Inc. CRC Press, Third Edition
5. Material selection and Design, Vol. 20 - ASM Hand book.

Course Outcome:

Students will have added capability to include manufacturability in mechanical engineering design of parts and their assemblies.

ADVANCED FLUID DYNAMICS
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MEA155 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective:

The student will gain knowledge of dynamics of fluid flow under different conditions.

1. **Review of undergraduate Fluid Mechanics** : Differential Flow analysis- Continuity equation (3D Cartesian, Cylindrical and spherical coordinates) Navier Stokes equations (3D- Cartesian, coordinates) Elementary inviscid flows; superposition (2D). **8 Hours**
2. **Integral Flow Analysis:** Reynolds transport theorem, Continuity, momentum, moment of momentum, energy equations with applications such as turbo machines, jet propulsion &propellers;
Exact solution of viscous flow equations: Steady flow: Hagen Poiseuille problem, plane Poiseuille problem, Unsteady flow: Impulsively started plate
12 Hours
3. **Low Reynolds number flows:**Lubrication theory (Reynolds equation), flow past rigid sphere, flow past cylinder
Boundary Layer Theory:Definitions, Blasius solution, Von-Karman integral, Separation, **10 Hours**
4. Thermal Boundary layer and heat transfer, (Laminar & turbulent flows);
Experiments in fluids: Wind tunnel, Pressure Probes, Anemometers and flow meters
10 Hours
5. **Special Topics:**Stability theory; Natural and forced convection; Rayleigh Benardproblem;Transition to turbulence; Introduction to turbulent flows
10 Hours

Text Books:

1. "Foundations of fluid mechanics" - S. W. Yuan,SI Unit edition, 1988.
2. "Advanced Engineering Fluid Mechanics"- K. Muralidhar& G. Biswas, Narosa Publishers, 1999.

Reference Books:

1. "Physical Fluid Dynamics" 2nd edition – D.J. Tritton, Oxford Science Publications, 1988.
2. "Boundary Layer Theory"8th edition, H. Schlichting, McGraw Hill, New York., 1999.

Course Outcome:

The student will be able to apply concepts of fluid dynamics in solving real time problems.

Design Engineering Laboratory – Lab 1
(Common to MDE,MEA,MMD,CAE,MCS)

Sub Code : 16MDE16 IA Marks :20
Hrs/ Week : 3 Exam Hours : 03
Total Hrs:42 Exam Marks : 80

Note:

- 1) These are independent laboratory exercises
- 2) A student may be given one or two problems stated herein
- 3) Student must submit a comprehensive report on the problem solved and give a Presentation on the same for Internal Evaluation
- 4) Any one of the exercises done from the following list has to be asked in the Examination for evaluation.

Course Content:

Experiment #1

Numerically Calculation and MATLAB Simulation

Part A: Invariants, Principal stresses and strains with directions

Part A: Maximum shear stresses and strains and planes, Von-Mises stress

Part C: Calculate and Plot Stresses in Thick-Walled Cylinder

Experiment #2

Stress analysis in Curved beam in 2D

Part A : Experimental studies using Strain Gauge Instrumentation.

Part B : 2D Photo elastic Investigation.

Part C :Modelling and Numerical Analysis using FEM.

Experiment #3

Stress analysis of rectangular plate with circular hole under i. Uniform Tension and ii. shear

Part A: Matlab simulation for Calculation and Plot of normalized hoop Stress at hole boundary in Infinite Plate

Part B: Modelling of plate geometry under chosen load conditions and study the effect of plate geometry.

Part C: Numerical Analysis using FEA package.

Experiment #4

Single edge notched beam in four point bending.

Part A: Modeling of single edge notched beam in four point bending. Part B:

Numerical Studies using FEA.

Part C: Correlation Studies.

Experimental #5

Torsion of Prismatic bar with Rectangular cross-section. Part A: Elastic

solutions, MATLAB Simulation

Part B: Finite Element Analysis of any chosen geometry. Part C:

Correlation studies.

Experiment #6

Contact Stress Analysis of Circular Disc under diametrical compression

Part A: 3-D Modeling of Circular Discs with valid literature background, supported with experimental results on contact stress. Part B:

Numerical Analysis using any FEA package.

Part C: 2D Photo Elastic Investigation.

Experiment #7

Vibration Characteristics of a Spring Mass Damper System. Part A:

Analytical Solutions.

Part B: MATLAB Simulation. Part C:

Correlation Studies.

Experiment #8

Modelling and Simulation of Control Systems using MATLAB.

Common to Design Engineering (MDE), Engineering Analysis & Design (MEA),
Machine Design (MMD), Computer Aided Engineering (CAE)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. Machine Design**

II SEMESTER

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16MST 21	Composite Materials Technology	4	2	3	20	80	100	4
16MDE 22	Advanced Machine Design	4	2	3	20	80	100	4
16MDE 23	Dynamics & Mechanism Design	4	2	3	20	80	100	4
16MDE 24	Advanced Theory of Vibrations	4	2	3	20	80	100	4
16XXXXXX	Elective – II	4	2	3	20	80	100	4
16MDE 26	Design Engineering Lab II	--	3	3	20	80	100	2
16MMD 27	SEMINAR	--	--	--	100	--	100	1
	**PROJECT WORK PHASE-I COMMENCEMENT (6 WEEKS DURATION)	--	--	--	--	--	--	-
Total		20	13	18	220	480	700	23

ELECTIVE-II

16CAE 251	Design Optimization	16CAE 253	Advanced Manufacturing Process Simulation
16MDE252	Theory of Plasticity	16MDE 254	Rotor Dynamics
16MEA255	Automobile System Design		

**** Between the II Semester and III Semester, after availing a vacation of 2 weeks.**

II Semester

COMPOSITE MATERIALS TECHNOLOGY

(Common to MDE, MEA, MMD, CAE)

Sub Code: 16MST21 IA Marks: 20

Hrs/ Week: 04 Exam Hours: 03

Total Hrs: 50 Exam Marks: 80

Course Objective:

Mechanics of composite materials provides a methodology for stress analysis and progressive failure analysis of laminated composite structures for aerospace, automobile, marine and other engineering applications.

Course Content:

Module 1: Introduction to Composite Materials: Definition, Classification, Types of matrices material and reinforcements, Characteristics & selection, Fiber composites, laminated composites, Particulate composites, Prepegs, and sandwich construction.

Metal Matrix Composites: Reinforcement materials, Types, Characteristics and selection, Base metals, Selection, Applications

Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Derivation of nine independent constants for orthotropic material, Two - dimensional relationship of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Invariant properties. Stress-Strain relations for lamina of arbitrary orientation, Numerical problems.

10 Hours

Module 2: Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli, Rule of mixture, Numerical problems. Experimental Characterization of Lamina- Elastic Moduli and Strengths

Failure Criteria: Failure criteria for an elementary composite layer or Ply, Maximum Stress and Strain Criteria, Approximate strength criteria, Inter-laminar Strength, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problem, practical recommendations.

10 Hours

Module 3: Macro Mechanical Analysis of Laminate: Introduction, code, Kirchhoff hypothesis, Classical Lamination Theory, A, B, and D matrices (Detailed derivation), Special cases of laminates, Numerical problems. Shear Deformation Theory, A, B, D and E matrices (Detailed derivation)

10 Hours

Module 4: Analysis of Composite Structures: Optimization of Laminates, composite laminates of uniform strength, application of optimal composite structures, composite pressure vessels, spinning composite disks, composite lattice structures.

Applications: Aircrafts, missiles, Space hardware, automobile, Electrical and Electronics, Marine, Recreational and sports equipment-future potential of composites. **10 Hours**

Module 5: Manufacturing and Testing: Layup and curing - open and closed mould processing, Hand lay-up techniques, Bag moulding and filamentwinding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining, joining and repair.

NDT tests – Purpose, Types of defects, NDT method - Ultrasonic inspection, Radiography, Acoustic emission and Acoustic ultrasonic method. **10 Hours**

Text Books:

1. Autar K. Kaw, Mechanics of Composite materials, CRC Press, 2nd Ed, 2005.
2. Madhijit Mukhopadhyay, Mechanics of Composite Materials & Structures, Universities Press, 2004.

Reference Books:

1. J. N. Reddy, Mechanics of Laminated Composite Plates & Shells, CRD Press, 2nd Ed, 2004.
2. Mein Schwartz, Composite Materials handbook, McGraw Hill, 1984.
3. Rober M. Jones, Mechanics of Composite Materials, Taylor & Francis, 1998.
4. Michael W, Hyer, Stress analysis of fiber Reinforced Composite Materials, Mc-Graw Hill International, 2009.
5. Composite Material Science and Engineering, Krishan K. Chawla, Springer, 3e, 2012.
6. Fibre Reinforced Composites, P.C. Mallik, Marcel Decker, 1993.
7. Hand Book of Composites, P.C. Mallik, Marcel Decker, 1993

Course Outcome:

This course provides the background for the analysis, design, optimization and test simulation of advanced composite structures and Components.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

ADVANCED MACHINE DESIGN
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE22 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective:

This course enables the student to identify failure modes and evolve design by analysis methodology. Design against fatigue failure is given explicit attention.

Course Content:

Module 1: Introduction: Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory. Numerical examples.

Fatigue of Materials: Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods ,Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features. **10 Hours**

Module 2: Stress-Life (S-N) Approach: S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S- N approach.

Strain-Life(ϵ -N)approach: Monotonic stress-strain behavior ,Strain controlled test methods ,Cyclic stress-strain behavior ,Strain based approach to life estimation, Determination of strain life fatigue properties, Mean stress effects, Effect of surface finish, Life estimation by ϵ -N approach. **10 Hours**

Module 3: LEFM Approach: LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects, Crack growth life estimation.

Notches and their effects: Concentrations and gradients in stress and strain, S-N approach for notched membranes, mean Stress effects and Haigh diagrams, Numerical examples. **10 Hours**

Module 4: Fatigue from Variable Amplitude Loading: Spectrum loads and cumulative damage, Damage quantification and the concepts of damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach. Numerical examples.

Notch strain analysis: Strain – life approach, Neuber’s rule, Glinka’s rule, applications of fracture mechanics to crack growth at notches. Numerical examples. **10 Hours**

Module 5: Surface Failure: Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear.

Surface fatigue: spherical contact, Cylindrical contact, General contact, Dynamic contact stresses, Surface fatigue strength, Surface fatigue failure modes, Design to avoid Surface failures. **10 Hours**

Text Books:

1. Ralph I. Stephens, Ali Fatemi, Robert, Henry o. Fuchs, “Metal Fatigue in engineering”, John wileyNewyork, Second edition. 2001.
2. Failure of Materials in Mechanical Design, Jack. A. Collins, John Wiley, Newyork 1992.
3. Robert L. Norton , “Machine Design”, Pearson Education India, 2000

Reference Books:

1. S.Suresh , “Fatigue of Materials”, Cambridge University Press, -1998
2. Julie.A.Benantine , “Fundamentals of Metal Fatigue Analysis”, Prentice Hall,1990
3. Fatigue and Fracture, ASM Hand Book, Vol 19,2002.

Course Outcome:

This course enriches the student with state of the art design methodology namely design by analysis and damage tolerant design.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

DYNAMICS AND MECHANISM DESIGN
(Common to MDE,MEA,MMD)

Sub Code : 16MDE 23 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks :80

Course Objective:

To include dynamics considerations in the design of mechanisms for engineering applications is the objective of this course.

Course Content:

Module 1: Geometry of Motion: Introduction, analysis and synthesis, Mechanism terminology, planar, Spherical and spatial mechanisms, mobility, Grashoffs law, Equivalent mechanisms, unique mechanisms.

Kinematic analysis of plane mechanisms: Auxiliary point method using rotated velocity vector, Hall - Ault auxiliary point method, Goodman's indirect method. Numerical examples. **08 Hours**

Module 2: Generalized Principles of Dynamics: Fundamental laws of motion, Generalized coordinates, Configuration space, Constraints, Virtual work, principle of virtual work, Energy and momentum, Work and kinetic energy, Equilibrium and stability, Kinetic energy of a system, Angular momentum, Generalized momentum.

Lagrange's Equation: Lagrange's equation from D'Alembert's principles, Examples, Hamiltons equations, Hamiltons principle, Lagrange's, equation from Hamiltons principle, Derivation of Hamiltons equations, Numerical examples. **12 Hours**

Module 3: Synthesis of Linkages: Type, number, and dimensional synthesis, Function generation, Path generation and Body guidance, Precision positions, Structural error, Chebychev spacing, Two position synthesis of slider crank mechanisms, Crank-rocker mechanisms with optimum transmission angle

Motion Generation: Poles and relative poles, Location of poles and relative poles, polode, Curvature, Inflection circle. Numerical examples. **10 Hours**

Module 4: Graphical Methods of Dimensional Synthesis: Two position synthesis of crank and rocker mechanisms, Three position synthesis, Four position synthesis (point precision reduction) Overlay method, Coupler curve synthesis, Cognate linkages.

Analytical Methods of Dimensional Synthesis: Freudenstein's equation for four bar mechanism and slider crank mechanism, Examples, Bloch's method of synthesis, Analytical synthesis using complex algebra. **12 Hours**

Module 5: System Dynamics: Gyroscopic action in machines, Euler's equation of motion, Phase Plane representation, Phase plane Analysis, Response of Linear Systems to transient disturbances.

Spatial Mechanisms: Introduction, Position analysis problem, Velocity and acceleration analysis, Eulerian angles. Numerical examples. **08 Hours**

Text Books:

1. K.J.Waldron&G.L.Kinzel , “Kinematics, Dynamics and Design of Machinery”, Wiley India, 2007.
2. Greenwood , “Classical Dynamics”, Prentice Hall of India, 1988.

References Books:

1. J E Shigley, “Theory of Machines and Mechanism” -McGraw-Hill, 1995
2. A.G.Ambekar , “Mechanism and Machine Theory”, PHI, 2007.
3. Ghosh and Mallick , “Theory of Mechanism and Mechanism”, East West press 2007.
4. David H. Myszka , “Machines and Mechanisms”, Pearson Education, 2005.

Course Outcome:

The knowledge of dynamics considerations in mechanism design is essential to use commercial multi body dynamics software in mechanical engineering design

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

ADVANCED THEORY OF VIBRATIONS
(Common to MDE, MEA, MMD, CAE)

Sub Code: 16MDE24 IA Marks: 20
Hrs/ Week: 04 Exam Hours: 03
Total Hrs: 50 Exam Marks: 80

Course Objective:

To teach students how to use the theoretical principles of vibration, and vibration analysis techniques, for the practical solution of vibration problems. The course builds on student's prior knowledge of vibration theory, and concentrates on the applications. The student will understand the importance of vibrations in mechanical design of machine parts subject to vibrations.

Course Content:

Module 1: Review of Mechanical Vibrations: Basic concepts; free vibration of single degree of freedom systems with and without damping, forced vibration of single DOF-systems, Natural frequency.

Vibration Control: Introduction, Vibration isolation theory, Vibration isolation and motion isolation for harmonic excitation, practical aspects of vibration analysis, vibration isolation, Dynamic vibration absorbers, and Vibration dampers. **12 hours**

Module 2: Vibration Measurement and applications: Introduction, Transducers, Vibration pickups, Frequency measuring instruments, Vibration exciters, Signal analysis.

Modal analysis & Condition Monitoring: Dynamic Testing of machines and Structures, Experimental Modal analysis, Machine Condition monitoring and diagnosis. **10 hours**

Module 3: Transient Vibration of single Degree-of freedom systems: Impulse excitation, arbitrary excitation, Laplace transform formulation, Pulse excitation and rise time, Shock response spectrum, Shock isolation.

Random Vibrations : Random phenomena, Time averaging and expected value, Frequency response function, Probability distribution, Correlation, Power spectrum and power spectral density, Fourier transforms and response. **10 hours**

Module 4: Non Linear Vibrations: Introduction, Sources of nonlinearity, Qualitative analysis of nonlinear systems. Phase plane, Conservative systems, Stability of equilibrium, Method of isoclines, Perturbation method, Method of iteration, Self-excited oscillations. **10 hours**

Module 5: Continuous Systems: Vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler equation for beams. **08 hours**

Text Books

1. S. S. Rao, "Mechanical Vibrations", Pearson Education, 4th edition.
2. S. Graham Kelly, "Fundamentals of Mechanical Vibration" - McGraw-Hill, 2000
3. Theory of Vibration with Application, - William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, 5th edition Pearson Education.

Reference Books

1. S. Graham Kelly, "Mechanical Vibrations", Schaum's Outlines, Tata McGraw Hill, 2007.
2. C Sujatha, "Vibrations and Acoustics – Measurements and signal analysis", Tata McGraw Hill, 2010.

Course Outcome:

At the end of the course the student will be able to solve major and realistic vibration problems in mechanical engineering design that involves application of most of the course syllabus.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Elective-II

DESIGN OPTIMIZATION

(Common to MDE,MEA, MMD,CAE)

Sub Code : 16CAE251 IA Marks : 20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks : 80

Course Objective:

It aids the students to acquire the basics of optimum design, Classical Optimization Techniques, Non - linear Programming, Unconstrained Optimization Techniques, Integer Programming and Dynamic Programming.

Course Content:

Module 1: Engineering Design Practice: Evolution of Design Technology, Introduction to Design and the Design Process, Design versus Analysis, Role of Computers in Design Cycle, Impact of CAE on Design, Numerical Modeling with FEA and Correlation with Physical Tests.

Applications of Optimization in Engineering Design: Automotive, Aerospace and General Industry Applications, Optimization of Metallic and Composite Structures, Minimization and Maximization Problems, MDO and MOO. **10 Hours**

Module 2: Optimum Design Problem Formulation: Types of Optimization Problems, The Mathematics of Optimization, Design Variables and Design Constraints, Feasible and Infeasible Designs, Equality and Inequality Constraints, Discrete and Continuous Optimization, Linear and Non Linear Optimization.

Optimization Theory – Fundamental Concepts, Global and Local Minimum, Gradient Vector and Hessian Matrix, Concept of Necessary and Sufficient Conditions, Constrained and Unconstrained Problems, Lagrange Multipliers and Kuhn Tucker Conditions. **10 Hours**

Module 3: Sensitivity Analysis: Linear and Non Linear Approximations. Gradient Based Optimization Methods – Dual and Direct.

Optimization Disciplines: Conceptual Design Optimization and Design Fine Tuning, Combined Optimization, Optimization of Multiple Static and Dynamic Loads, Transient Simulations, Equivalent Static Load Methods. Internal and External Responses, Design Variables in Each Discipline. **10 Hours**

Module 4: Manufacturability in Optimization Problems: Design For Manufacturing, Manufacturing Methods and Rules, Applying Manufacturing Constraints to Optimization Problems.

Design Interpretation: Unbound Problems, Over Constrained Problems, Problems with No of Multiple Solutions, Active and Inactive Constraints, Constraint Violations and Constraint Screening, Design Move Limits, Local and Global Optimum .

10 Hours

Module 5: Dynamic Programming: Introduction, Multistage decision processes, Principle of optimality, Computational Procedure in dynamic programming, Initial value problem, Examples.

10 Hours

Text Books:

1. S.S.Rao, Engineering Optimization: Theory and Practice, John Wiley, 2009
2. JasbirArora, Introduction to Optimum Design, McGraw Hill, 2011.

Reference Books:

1. Optimisation and Probability in System Engg - Ram, Van Nostrand.
2. Optimization methods - K. V. Mital and C. Mohan, New age International Publishers, 1999.
3. Optimization methods for Engg. Design - R.L Fox, Addison – Wesley, 1971.

Course Outcome:

It provides the student with knowledge required to optimize an existing design with single or multiple objective functions. However the skills have to be acquired through commercial optimization programs

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

THEORY OF PLASTICITY

(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE252 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks : 80

Course Objective:

This course focuses on stress-strain relations, yield criteria and associated flow rules for elastic-plastic analysis of components and structures

Course Content:

Module 1: Definition and scope of the subject, Brief review of elasticity, Octahedral normal and shear stresses, Spherical and deviatoric stress, Invariance in terms of the deviatoric stresses, Idealised stress-strain diagrams for different material models, Engineering and natural strains, Mathematical relationships between true stress and true strains, Cubical dilation, finite strains co-efficient Octahedral strain, Strain rate and the strain rate tensor. **10hours**

Module 2: Material Models, Stress-strain relations, Yield criteria for ductile metal, Von Mises, Tresca, Yield surface for an Isotropic Plastic materials, Stress space, Experimental verification of Yield criteria, Yield criteria for an anisotropic material, flow rule normality, Yield locus, Symmetry convexity, Deformation of isotropic and kinematic hardening, bilinear stress-strain relationship, power law hardening, deformation theory of plasticity, J_2 flow theory, J_2 incremental theory,. **10hours**

Module 3: Plastic stress-strain relations, Prandtl- Rouss Saint Venant, Levy-Von Mises, Experimental verification of the Prandtl- Rouss equation Upper and lower bound theorems and corollaries, Application to problems: Uniaxial tension and compression, Stages of plastic yielding,. **10 Hours**

Module 4: Bending of beams, Torsion of rods and tubes, nonlinear bending and torsion equations. Application of metal forming: Drawing and Extrusion process, stresses in drawing and extruding with and without friction. **10 hours**

Module 5: Sliplinetheory,Introduction, Basic equations for incompressible two dimensional flow, continuity equations, Stresses in conditions of plain strain conventionforslip-lines,Geometryofsliplines,Propertiesofsliplines, Computational Plasticity- Finite element method, Formulations, Plasticity models **10hours**

Text Books

1. Engineering Plasticity - Theory and Application to Metal Forming Process -R.A.C..Slater, McMillan Press Ltd., 1977
2. Theory of Plasticity and Metal forming Process - Sadhu Singh, Khanna Publishers, Delhi, 1999.

Reference Books

1. Introduction to the Theory of Plasticity for Engineers- Haffman and Sachs, LLC, 2012.
2. Theory of plasticity - J Chakrabarty, Butterworth, 2006.
3. Plasticity for Mechanical Engineers - Johnson and Mellor, Van Nostrand, 1966.

Course Outcome:

The students learn the theory of plasticity as a background for nonlinear analysis (Material nonlinearity) by the Finite element method.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

ADVANCED MANUFACTURING PROCESSES SIMULATION

(Common to MDE,MEA,MMD,CAE)

Sub Code : 16CAE253

IA Marks :20

Hrs/ Week : 04

Exam Hours : 03

Total Hrs: 50

Exam Marks : 80

Course Objective:

The course aims at bringing in clear understanding of finite element modeling for simulation of various manufacturing processes.

Course Content:

Module 1: Finite Element Models of Sheet Metal Forming Processes: Introduction, fundamentals of continuum mechanics- strain and stress measurement, Material Models , FE-Equations for Small Deformations, FE-Equations for Finite Deformations, Flow Approach- Eulerian FE-Formulations for Rigid-Plastic Sheet Metal Analysis, The Dynamic, Explicit Method, Historical Review of Sheet Forming Simulation

Plastic Behaviour of Sheet Metal: Anisotropy of Sheet Metals- Uniaxial and biaxial Anisotropy Coefficients, Yield Criteria for Isotropic Materials, Classical Yield Criteria for Anisotropic Materials.

10 Hours

Module 2: Advanced Anisotropic Yield Criteria:Banabic-Balan-Comsa (BBC) 2005 Yield Criterion, Banabic-Balan-Comsa (BBC) 2008 Yield Criterion, Recommendations on the Choice of the Yield Criterion, Modeling of the Bauschinger Effect.

Formability of Sheet Metals: Evaluation of the Sheet Metal Formability-method based on simulation test and limit dome height diagram, Forming Limit Diagram- definition, experimental determination, methods of determining the limit strain, factors influencing the forming limit, Theoretical Predictions of the Forming Limit Curves, Semi-empirical Model.

10 Hours

Module 3:Numerical Simulation of the Sheet Metal Forming Processes: Simulation of the Elementary Forming Processes. Simulation of the Industrial Parts Forming Processes, Robust Design of Sheet Metal Forming Processes, The Spring-back Analysis, Computer Aided Spring- back Compensation.

Forging: Classification, various stages during forging, Forging equipment, brief description, deformation in compression, forging defects. Residual stresses in forging.

10 Hours

Module 4: Rolling :Classification, forces and geometrical relationships in rolling., Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower.

Drawing and Extrusion:Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and

wire drawing. Extrusion equipment, Classification, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion. **10 Hours**

Module 5: Composite Materials and Honeycomb Structures: Manufacturing processes and environmental requirements for manufacturing of composite components, NDT methods and quality control, sandwich structures and adhesive bonding. Heat Treatment Processes: Purpose of heat treatment and theory of heat treatment processes, heat treatment of alloys of aluminum, magnesium, titanium, steel and case hardening. **10 Hours**

Text Books

1. **Dorel Banabic**, Sheet Metal Forming Processes: Constitutive Modeling and Numerical Simulation, Springer, 2010.
2. **Dieter G.E.** Mechanical Metallurgy, McGraw Hill, 1986.
3. **ASM** Metals Handbook –Volume II.

Reference Books:

1. **Aircraft Materials and Manufacturing Process** - George F.Titterton, published by Himalayan books, New Delhi, 1968.
2. **Aircraft Production Technology and Management** - ChennaKeshu S and Ganapathy K K, Interline Publishing, Bangalore, 1993.
3. **SachG** "Fundamentals of working of metals" Pergamon Press.
4. **N Bhatnagar, T S Srivatsan**, "Processing and Fabrication of Advanced Materials", IK International
5. **Phillip F. Ostwald, Jairo Muñoz**, "Manufacturing processes and systems", John Wiley, 1997.
6. **Stephen F. Krar, Arthur Gill**, "Exploring advanced manufacturing technologies", Industrial Press, 2003.
7. **Kobayashi** "Metal forming and finite element methods", Oxford, 1989.
8. **PrakashMahadeo Dixit, Uday S. Dixit**, "Modeling of metal forming and machining processes", Springer, 2008.
9. **Dorel Banabic**, "Advanced Methods in Material Forming", Springer, 2007.
10. **Schuler GmbH**, "Metal forming handbook", Springer, 1998.

Course Outcome:

Students will be able to analyse the behaviour of materials during forming.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

ROTOR DYNAMICS
(Common to MDE,MEA,MMD)

Sub Code : 16MDE254 IA Marks :20
Hrs/ Week : 04 Exam Hours : 03
Total Hrs: 50 Exam Marks : 80

Course Objective:

This course is of interest to turbo machinery designers. Specifically modeling of bearings, shafts and rotor stages (compressors, turbines including blades) to predict instability like whirling including gyroscopic and Coriolis effect.

Course Content:

Module 1: Fluid Film Lubrication: Basic theory of fluid film lubrication, Derivation of generalized Reynolds equations, Boundary conditions, Fluid film stiffness and Damping coefficients, Stability and dynamic response for hydrodynamic journal bearing, Two lobe journal bearings.

Stability of Flexible Shafts: Introduction, equation of motion of a flexible shaft with rigid support, Radial elastic friction forces, Rotary friction, friction Independent of velocity, friction dependent on frequency, Different shaft stiffness Constant, gyroscopic effects, Nonlinear problems of large deformation applied forces, instability of rotors in magnetic field. **12 Hours**

Module 2: Critical Speed: Dunkerley's method, Rayleigh's method, Stodola's method. Rotor Bearing System: Instability of rotors due to the effect of hydrodynamic oil layer in the bearings, support flexibility, Simple model with one concentrated mass at the center **08 Hours**

Module 3: Turborotor System Stability by Transfer Matrix Formulation: General turborotor system, development of element transfer matrices, the matrix differential equation, effect of shear and rotary inertia, the elastic rotors supported in bearings, numerical solutions. **10 Hours**

Module 4: Turborotor System Stability by Finite Element Formulation: General turborotor system, generalized forces and co-ordinates system assembly element matrices, Consistent mass matrix formulation, Lumped mass model, linearised model for journal bearings, System dynamic equations Fix stability analysis non dimensional stability analysis, unbalance response and Transient analysis. **12 Hours**

Module 5: Blade Vibration: Centrifugal effect, Transfer matrix and Finite element, approaches. **08 Hours**

Reference Books:

1. Cameron, "Principles of Lubrication", Longman Publishing Group, 1986
2. Bolotin , "Nonconservative problems of the Theory of elastic stability", Macmillan, 1963
3. Pezdel, Lockie , "Matrix Methods in Elasto Mechanics", McGraw-Hill, 1963.
4. Timosenko , "Vibration Problems in Engineering", Oxford City Press, 2011
5. Zienkiewicz, "The finite element method in engineering science", McGraw-Hill, 1971

Course Outcome:

Provides the student understanding of modeling a rotating machine elements theoretically. However rotor dynamic analysis demands FE Modeling using a commercial FEA software

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

AUTOMOBILE SYSTEM DESIGN
(Common to MDE, MMD, MEA and CAE)

Sub Code	:	16 MEA255	IA Marks	:	20
Hrs/ Week	:	04	Exam Hours	:	03
Total Hrs.	:	52	Exam Marks	:	80

Course Objective:

This course would facilitate understanding of the stages involved in automobile system design. The student will be exposed to industrial practices in design of various systems of an automobile.

Module 1: Body Shapes: Aerodynamic Shapes, drag forces for small family cars.

Fuel Injection: Spray formation, direct injection for single cylinder engines (both SI & CI), energy audit. **12 Hours**

Module 2: Design of I.C. Engine I: Combustion fundamentals, combustion chamber design, cylinder head design for both SI & C. I. Engines. **08 Hours**

Module 3: Design of I.C. Engine II: Design of crankshaft, camshaft, connecting rod, piston & piston rings for small family cars (max up to 3 cylinders). **10 Hours**

Module 4: Transmission System: Design of transmission systems – gearbox (max of 4-speeds), differential.

Suspension System: Vibration fundamentals, vibration analysis (single & two degree of freedom, vibration due to engine unbalance, application to vehicle suspension). **10 Hours**

Module 5: Cooling System: Heat exchangers, application to design of cooling system (water cooled).
Emission Control: Common emission control systems, measurement of emissions, exhaust gas emission testing.

10 Hours

Text Books:

1. **Design of Automotive Engines**, - A .Kolchin& V. Demidov, MIR Publishers, Moscow
2. **The motor vehicle, Newton steeds &Garratte** - Iliff& sons Ltd., London
3. **I.C. Engines** - Edward F Obert, International text book company.

Reference Books:

1. **Introduction to combustion** - Turns
2. **Automobile Mechanic** -, N.K.Giri, Khanna Publications, 1994
3. **I.C. Engines** - Maleev, McGraw Hill book company, 1976
4. **Diesel engine design** - HeldtP.M.,Chilton company New York.
5. **Problems on design of machine elements** - V.M. Faires&Wingreen, McMillan Company., 1965
6. **Design of I.C.Engines** - John Heywood, TMH

Course Outcome:

The student will be able to apply the knowledge in creating a preliminary design of automobile sub systems.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Design Engineering Laboratory - Lab 2
(Common to MDE,MEA,MMD,CAE,MCS)

Sub Code : 16MDE26	IA Marks : 20
Hrs/ Week : 6	Exam Hours : 03
Total Hrs: 42	Exam Marks : 80

Note:

- 1) These are independent laboratory exercises
- 2) A student may be given one or two problems stated herein
- 3) Student must submit a comprehensive report on the problem solved and give a Presentation on the same for Internal Evaluation
- 4) Any one of the exercises done from the following list has to be asked in the Examination for evaluation.

Course Content:

Experiment #1 Structural Analysis

Part A: FE Modeling of a stiffened Panel using a commercial preprocessor.

Part B: Buckling, Bending and Modal analysis of stiffened Panels.

Part C: Parametric Studies.

Experiment #2

Design Optimization

Part A: Shape Optimization of a rotating annular disk.

Part B: Weight Minimization of a Rail Car Suspension Spring.

Part C: Topology Optimization of a Bracket.

Experiment #3

Thermal analysis

Part A: Square Plate with Temperature Prescribed on one edge and Opposite edge insulated.

Part B: A Thick Square Plate with the Top Surface exposed to a Fluid at high temperature, Bottom Surface at room temperature, Lateral Surfaces Insulated.

Experiment #4

Thermal Stress Analysis

Part A: A Thick Walled Cylinder with specified Temperature at inner and outer Surfaces.

Part B: A Thick Walled Cylinder filled with a Fluid at high temperature and Outer Surface exposed to atmosphere.

Experiment#5

CFD Analysis

Part A: CFD Analysis of a Hydro Dynamic Bearing using commercial code.

Part B: Comparison of predicted Pressure and Velocity distributions with Target solutions.

Part C: Experimental Investigations using a Journal Bearing Test Rig.

Part D: Correlation Studies.

Experiment #6

Welded Joints.

Part A : Fabrication and Testing.

Part B : FE Modeling and Failure Analysis .

Part C : Correlation Studies.

Experiment #7

Bolted Joints.

Part A : Fabrication and Testing.

Part B : FE Modeling and Failure Analysis .

Part C : Correlation Studies.

Experiment #8

Adhesive Bonded Joints.

Part A : Fabrication and Testing.

Part B : FE Modeling and Failure Analysis .

Part C : Correlation Studies.

Common to Design Engineering (MDE), Engineering Analysis & Design (MEA),
Machine Design (MMD), Computer Aided Engineering (CAE)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. Machine Design**

III SEMESTER

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16MMD31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)				25	-	25	20
16MMD32	Report on Internship				25	-	25	
16MMD33	Evaluation and Viva-Voce of Internship				-	50	50	
16MMD34	Evaluation of Project phase -1				50	-	50	1
Total					100	50	150	21

Number of credits completed at the end of III semester: 22+ 22 + 21 = 65

Note: Internship of 16 weeks shall be carried out during III semester. Major part of the Project work shall also be carried out during the III semester in consultation with the Guide/s.

Common to Design Engineering (MDE), Engineering Analysis & Design (MEA),
Machine Design (MMD), Computer Aided Engineering (CAE)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. Machine Design

IV SEMESTER

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
16MMD41	Tribology and Bearing Design	04	-	03	20	80	100	4
16MMD42X	Elective - 3	03	-	03	20	80	100	3
16MMD43	Evaluation of Project phase -2	-	-	-	50	-	50	3
16MMD44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
Total		07	-	06	90	360	450	20
Number of credits completed at the end of IV semester: 22+ 22 + 21 + 20 = 85								

Elective -3	
Subject Code under 16MMD42X	Title
16CAE421	Fracture Mechanics
16MST422	Smart Materials & Structures
16MDE423	Robust Design
16MEA424	Computational Fluid Dynamics

- Note:** 1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.
2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee comprising of HoD as Chairman, Guide and Senior faculty of the department.
3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted.
4. Project evaluation: a. Internal Examiner shall carry out the evaluation for 100 marks. b. External Examiner shall carry out the evaluation for 100 marks. c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation. d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

IV Semester
TRIBOLOGY AND BEARING DESIGN
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE41
Hrs/ Week : 04
Total Hrs: 50

IA Marks :20
E x a m H o u r s : 0 3
Exam Marks :80

Course Objective:

Gives in-depth knowledge regarding hydrodynamic, hydrostatic lubrication and various bearings, with their design and applications

Course Content:

Module 1. Introduction to Tribology: Introduction, Friction, Wear, Wear Characterization, Regimes of lubrication, Classification of contacts, lubrication theories, Effect of pressure and temperature on viscosity. Newton's Law of viscous forces, Flow through stationary parallel plates. Hagen's poiseuille's theory, viscometers. Numerical problems, Concept of lightly loaded bearings, Petroff's equation, Numerical problems.

9Hrs

Module 2. Hydrodynamic Lubrications: Pressure development mechanism. Converging and diverging films and pressure induced flow. Reynolds's 2D equation with assumptions. Introduction to idealized slide bearing with fixed shoe and Pivoted shoes. Expression for load carrying capacity. Location of center of pressure, effect of end leakage on performance, Numerical problems Journal Bearings: Introduction to idealized full journal bearings. Load carrying capacity of idealized full journal bearings, Sommerfeld number and its significance, short and partial bearings, Comparison between lightly loaded and heavily loaded bearings, effects of end leakage on performance, Numerical problems.

10 Hrs

Module 3. Hydrostatic Bearings: Hydrostatic thrust bearings, hydrostatic circular pad, annular pad, rectangular pad bearings, types of flow restricters, expression for discharge, load carrying capacity and condition for minimum power loss, numerical problems, and hydrostatic journal bearings. EHL Contacts: Introduction to Elasto - hydrodynamic lubricated bearings. Introduction to 'EHL' constant. Grubin type solution.

11Hrs

Module 4. Antifriction bearings: Advantages, selection, nominal life, static and dynamic load bearing capacity, probability of survival, equivalent load, cubic mean load, bearing mountings. Porous Bearings: Introduction to porous and gas lubricated bearings. Governing differential equation for gas lubricated bearings, Equations for porous bearings and working principal, Fretting phenomenon and its stages.

11 Hrs

Module 5. Magnetic Bearings: Introduction to magnetic bearings, Active magnetic bearings. Different equations used in magnetic bearings and working principal. Advantages and disadvantages of magnetic bearings, Electrical analogy, Magneto-hydrodynamic bearings.

9 Hrs

Text Books

1. Mujamdar.B.C "Introduction to Tribology of Bearing", Wheeler Publishing, New Delhi 2001
2. Radzimovsky, "Lubrication of Bearings - Theoretical principles and design" Oxford press Company, 2000.

Reference Books

1. Dudley D.Fulier " Theory and practice of Lubrication for Engineers", New YorkCompany.1998
2. Moore "Principles and applications of Tribology" Pergamon press, 1975
3. Oscar Pinkus, BenoSternlicht, "Theory of hydrodynamic lubrication", McGraw-Hill, 1961
4. G W Stachowiak, A W Batchelor , "Engineering Tribology", Elsevier publication 1993.
5. Hydrostatic and hybrid bearings, Butterworth 1983.
6. F. M. Stansfield, Hydrostatic bearings for machine tools and similar applications, Machinery Publishing, 1970

Course Outcome:

Students develop skills to design and selection of bearings on Varioustribological factors to be considered in moving and rotating parts.

IV Semester Elective -3
FRACTURE MECHANICS
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16CAE421
Hrs/ Week : 04
Total Hrs: 50

IA Marks :20
E x a m H o u r s : 0 3
Exam Marks :80

Course Objective:

Fracture mechanics provides a methodology for prediction, prevention and control of fracture in materials, components and structures. It provides a background for damage tolerant design. It quantifies toughness as materials resistance to crack propagation.

Course Content:

Module 1. Fracture mechanics principles: Introduction and historical review, Sources of micro and macro cracks. Stress concentration due to elliptical hole, Strength ideal materials, Griffith's energy balance approach. Fracture mechanics approach to design. NDT and Various NDT methods used in fracture mechanics, Numerical problems. The Airy stress function. Complex stress function. Solution to crack problems. Effect of finite size. Special cases, Elliptical cracks, Numerical problems.

12Hrs

Module 2. . Plasticity effects, Irwin plastic zone correction. Dugdale approach. The shape of the plastic zone for plane stress and plane strain cases, Plastic constraint factor. The Thickness effect, numerical problems. Determination of Stress intensity factors and plane strain fracture toughness: Introduction, analysis and numerical methods, experimental methods, estimation of stress intensity factors. Plane strain fracture toughness test, The Standard test. Size requirements. Non-linearity. Applicability.

12 Hrs

Module 3. . The energy release rate, Criteria for crack growth. The crack resistance (R curve). Compliance, J integral. Tearing modulus. Stability. Elastic plastic fracture mechanics : Fracture beyond general yield. The Crack-tip opening displacement. The Use of CTOD criteria. Experimental determination of CTOD. Parameters affecting the critical CTOD. Use of J integral. Limitation of J integral.

12Hrs

Module 4. Dynamics and crack arrest: Crack speed and kinetic energy. Dynamic stress intensity and elastic energy release rate. Crack branching. Principles of crack arrest. Crack arrest in practice. Dynamic fracture toughness.

06 Hrs

Module 5. Fatigue crack propagation and applications of fracture mechanics: Crack growth and the stress intensity factor. Factors affecting crack propagation. variable amplitude service loading, Means to provide fail-safety, Required information for fracture mechanics approach, Mixed mode (combined) loading and design criteria.

08 Hrs

Text Books

1. David Broek, "Elementary Engineering Fracture Mechanics", Springer Netherlands, 2011
2. Anderson, "Fracture Mechanics-Fundamental and Application", T.L CRC press 1998.

Reference Books

1. Karen Hellan, "Introduction to fracture mechanics", McGraw Hill, 2nd Edition
2. S.A. Meguid, "Engineering fracture mechanics" Elsevier Applied Science, 1989
3. Jayatilaka, "Fracture of Engineering Brittle Materials", Applied Science Publishers, 1979
4. Rolfe and Barsom, "Fracture and Fatigue Control in Structures", Prentice Hall, 1977
5. Knott, "Fundamentals of fracture mechanisms", Butterworths, 1973

Course Outcome:

At the end of the course students will:

1. Develop basic fundamental understanding of the effects of cracklike defects on the performance of aerospace, civil, and mechanical Engineering structures.
2. Learn to select appropriate materials for engineering structures to insure damage tolerance.
3. Learn to employ modern numerical methods to determine critical crack sizes and fatigue crack propagation rates in engineering structures.
4. Gain an appreciation of the status of academic research in field of fracture mechanics.

IV Semester Elective -3
SMART MATERIALS AND STRUCTURES
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MST422
Hrs/ Week : 04
Total Hrs: 50

IA Marks :20
E x a m H o u r s : 0 3
Exam Marks :80

Course Objective:

Knowledge of smart materials and structures is essential designing mechanical systems for advanced engineering applications ,the course aims at training students in smart materials and structures application and analysis

Course Content:

Module 1. Smart Structures: Types of Smart Structures, Potential Feasibility of Smart Structures, Key Elements Of Smart Structures, Applications of Smart Structures. Piezoelectric materials, Properties, piezoelectric Constitutive Relations, Depoling and Coersive Field, field strain relation. Hysteresis, Creep and Strain Rate effects, Inchworm Linear Motor.**Beam Modeling:** Beam Modeling with induced strain Rate effects, Inchworm Linear Motor Beam Modeling with induced strain Actuation-single Actuators, dual Actuators, Pure Extension, Pure Bending harmonic excitation, Bernoulli-Euler beam Model, problems, Piezoelectrical Applications.

12Hrs

Module 2. Shape memory Alloy: Experimental Phenomenology, Shape Memory Effect, Phase Transformation, Tanaka's Constitutive Model, testing of SMA Wires, Vibration Control through SMA, Multiplexing. Applications Of SMA and Problems. **ER and MR Fluids:** Mechanisms and properties, Fluid Composition and behavior, The Bingham Plastic and Related Models, Pre-Yield Response.Post-Yield flow applications in Clatches, Dampers and Others.

13 Hrs

Module 3 Vibration Absorbers: series and Parallel Damped Vibrations (OverView), Active Vibration Absorbers, Fiber Optics, Physical Phenomena,Characteristics, Sensors, Fiber Optics in Crack Detection, applications.**Control of Structures:** Modeling, Control Strategies and Limitations, Active Structures in Practice.

13Hrs

Module 4. MEMS – Mechanical Properties of MEMS Materials, Scaling of Mechanical Systems, Fundamentals of Theory, The Intrinsic Characteristics of MEMS, Miniaturization, Microelectronics Integration.

06 Hrs

Module 5. Devices: Sensors and Actuators, Conductivity of Semiconductors, Crystal Planes and Orientation, (Stress and Strain Relations, Flexural Beam Bending Analysis Under Simple Loading Conditions), Polymers in MEMS, Optical MEMS Applications.

06 Hrs

Text Books

1. Smart Materials and Structures - M. V. Gandhi and B. So Thompson, Chapman and Hall, London; New York, 1992 (ISBN: 0412370107).
2. Smart Structures and Materials - B. Culshaw, Artech House, Boston, 1996 (ISBN :0890066817).
3. Smart Structures: Analysis and Design - A. V. Srinivasan, Cambridge University Press, Cambridge; New York, 2001 (ISBN: 0521650267).

Reference Books

- Electroceramics: Materials, Properties and Applications - A. J. Moulson and J. M. Herbert. John Wiley & Sons, ISBN: 0471497429
2. Piezoelectric Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors. Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN: 3540422595).
 3. Piezoelectric Actuators and Wtrasonic Motors - K. Uchino, Kluwer Academic Publishers, Boston, 1997 (ISBN: 0792398114).
 4. Handbook of Giant Magnetostrictive Materials - G. Engdahl, Academic Press, San Diego, Calif.; London, 2000 (ISBN: 012238640X).
 5. Shape Memory Materials - K. Otsuka and C. M. Wayman, Cambridge University Press, Cambridge; New York, 199~ (ISBN: 052144487X).

Course Outcome:

At the completion of this course, students will be able to:

1. Understand the behavior and applicability of various smart materials
2. Design simple models for smart structures & materials
3. Perform simulations of smart structures & materials application
4. Conduct experiments to verify the predictions

IV Semester Elective -3
ROBUST DESIGN
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MDE423

Hrs/ Week : 04

Total Hrs: 50

IA Marks :20

E x a m H o u r s : 0 3

Exam Marks :80

Course Objective:

Course aims at giving orientation to design of experiments and taguchi's orthogonal array techniques which are predominantly used in optimization of parameters.

Course Content:

Module 1. Quality by Experimental Design : Quality, western and Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions. Robust Design : Steps in robust design : parameter design and tolerance design, reliability improvement through experiments, illustration through numerical examples.

Experimental Design: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and three factors. 3-level experiment designs for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples.

12Hrs

Module 2. Measures of Variability : Measures of variability, Concept of confidence level, Statistical distributions : normal, log normal and Weibull distributions. Hypothesis testing, Probability plots, choice of sample size illustration through numerical examples. Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and plotting method, Analysis of variance (ANOVA), in factorial experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples.

14 Hrs

Module 3. Taguchi's Orthogonal Arrays : Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays. Signal to Noise ratio (S-N Ratios) : Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller – the – better types, Nominal – the –better – type, larger – the- better – type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

14Hrs

Module 4. Parameter Design and Tolerance Design : Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance design strategy, Illustrations through numerical examples.

06 Hrs

Module 5. . Reliability Improvement Through Robust Design : Role of S-N ratios in reliability improvement ; Case study; Illustrating the reliability improvement of routing process of a printed wiring boards using robust design concepts.

04 Hrs

Text Books

1. Madhav S. Phadake , "Quality Engineering using Robust Design", Prentice Hall, 1989.
2. Douglas Montgomery, "Design and analysis of experiments", Wiley India Pvt.Ltd., 2007.
3. Phillip J. Ross, Taguchi , "Techniques for Quality Engineering", McGraw Hill Int. Ed., 1996

Reference Books

- Thomas B. Barker , "Quality by Experimental Design", Marcel Dekker Inc ASQC Quality Press, 1985
2. C.F. Jeff Wu, Michael Hamada , "Experiments planning, analysis and parameter design optimization", John Willey Ed., 2002
 3. W.L. Condra, Marcel Dekker , "Reliability improvement by Experiments", Marcel Dekker Inc ASQC Quality Press, 1985

Course Outcome:

After taking this course, a student will:

1. Have knowledge, understanding and the ability to apply methods to analyze and identify opportunities to improve design processes for robustness
2. Be able to lead product development activities that include robust design techniques.

IV Semester Elective -3
COMPUTATIONAL FLUID DYNAMICS
(Common to MDE,MEA,MMD,CAE)

Sub Code : 16MEA424

Hrs/ Week : 04

Total Hrs: 50

IA Marks :20

E x a m H o u r s : 0 3

Exam Marks :80

Course Objective:

This course would create awareness about the theory behind fluid dynamics computations as applied in analysis tools.

Course Content:

Module 1. . Basic Concepts - Dimensionless form of equations; Simplified mathematical models; Hyperbolic, Parabolic & Elliptic systems; Properties of numerical solutions (Consistency, Stability, Conservation, Convergence and Accuracy).

08Hrs

Module 2. . Finite Difference Methods - Discretisation; Boundary conditions; error propagation; Introduction to spectral methods; examples.

10 Hrs

Module 3 Finite volume method - Surface & volume integrals; Interpolation & differentiation; Boundary conditions; Examples.

10Hrs

Module 4. . Gaussian Elimination; LU decomposition; Tridiagonal Systems; Iterative methods; convergence; ADI & other splitting methods.

Multi-grid method - Coupled equations; Simultaneous solutions, sequential solutions & under relaxation. Non linear systems

10 Hrs

Module 5. Initial value problem & Boundary value problems; Implicit & Explicit Schemes; 2D and 3D examples. Heat and Mass transfer Problems; Multi Phase Flows.

12 Hrs

Text Books

1. **Computational Methods for Fluid Dynamics**, 3rd edition - J.H. Ferziger & M. Peric, Springer, 2002.
2. **Numerical Solutions of Partial Differential Equations, Finite Difference methods**, 3rd ed., - G.D. Smith, Oxford University Press. 1986.

Reference Books

1. **Computational Fluid Dynamics** - T. J. Chung, Cambridge Univ. Press, 2002.
2. **Partial Differential Equations for Scientists and Engineers** - Farlow, John Wiley, 1982.

Course Outcome:

The student will be able to analyse and obtain numerical solutions to fluid dynamics problems.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD11	Advanced Mathematics	4	2	3	50	100	150	4
14EVE12	Digital VLSI Design	4	2	3	50	100	150	4
14EVE13	Advanced Embedded Systems	4	2	3	50	100	150	4
14ELD14	Digital Circuits and Logic Design	4	2	3	50	100	150	4
14ELD15X	Elective - I	4	2	3	50	100	150	4
14ELD16	Digital Electronics Lab -I	--	3	3	25	50	75	2
14ELD17	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective-1

14 ELD 151	Digital System Design using Verilog	1
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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD21	Modern DSP	4	2	3	50	100	150	4
14ELD22	Coding Theory	4	2	3	50	100	150	4
14ELD23	Digital Signal Compression	4	2	3	50	100	150	4
14ELD24	Real Time Operating Systems	4	2	3	50	100	150	4
14ELD25X	Elective-2	4	2	3	50	100	150	4
14ELD26	Digital Electronics Lab -2		3	3	25	50	75	2
14ELD27	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
**Project Phase-I(6 week Duration)								
Total		20	16	18	300	550	850	23

Elective -2:

14 ELD 252	Synthesis & Optimization of Digital Circuits
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** Between the II Semester and III Semester, after availing a vocation of 2 weeks.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

III Semester: INTERNSHIP #

CREDIT BASED

Course Code	Subject	Teaching hours/week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14ELD31	Midterm Presentation on Internship (After 8 weeks from the date of commencement) *	-	-	-	25	-	25	1
14ELD32	Report on Internship (After 16 weeks from the date of commencement)	-	-	-	75		75	15
14ELD33	Evaluation and Viva-voce	-	-	3	-	50	50	4
	Total	-	-	-	100	50	150	20

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
 SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

IV Semester

CREDIT BASED

Subject Code	Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment / Tutorials		L.A.	Exam		
14ELD41	Advanced Computer Architecture	4	2	3	50	100	150	4
14ELD42X	Elective-3	4	2	3	50	100	150	4
14ELD43	Evaluation of Project Phase-I	-	-	-	25	-	25	1
14ELD44	Phase-II : Midterm evaluation of Project	-	-	-	25	-	25	1
<u>14ELD45</u>	Evaluation of Project Work and Viva-voce	-	-	3	-	100+100	200	18
Total		8	04	09	150	400	550	28
Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits								

Elective -3:

14 EVE 421	Advances in VLSI Design
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Note:

- 1) Project Phase - I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carry out literature survey & visit to Industries to finalize the topic of dissertation.
- 2) Project Phase - II: 16 weeks duration during III Semester. Evaluation shall be taken during the Second week of the IV Semester. Total Marks shall be 25.
- 3) Project Evaluation: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 250 (Phase I Evaluation: 25 Marks, Phase -II Evaluation: 25 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase - I & II shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (Out of two external examiners at least one should be present).

Advanced Mathematics

Subject Code	: 14ELD11	IA Marks	: 50
No. of Lecture Hours / Week	: 04	Exam. Hours	: 03
Total No. of Lecture Hours	: 50	Exam. Marks	: 100

Matrix Theory

QR-EL Decomposition – Eigen values using shifted QR algorithm- Singular Value EL Decomposition - Pseudo inverse- Least square approximations

Calculus of Variations

Concept of Functionals- Euler's equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso perimetric problems- Variational problems with moving boundaries

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of a elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi infinite rod.

Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions

Reference Books:

1. Richard Bronson, "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
2. Venkataraman M K, "Higher Engineering Mathematics", National Pub. Co, 1992
3. Elsgolts, I., "Differential Equations and Calculus of Variations", Mir, 1977.
4. Sneddon, I.N., "Elements of Partial differential equations", Dover Publications, 2006.
5. Sankara Rao, K., "Introduction to partial differential equations", Prentice - Hall of India, 1995
6. Taha H A, "Operations research - An introduction", McMilan Publishing co, 1982.

Digital VLSI Design

Subject Code : 14EVE12
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure. The MOS System under External Bias. Structure and Operation of MOS Transistor. MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.

MOS Inverters: Static Characteristics: Introduction, Resistive-Load Inverter. Inverters with n_Type MOSFET Load. CMOS Inverter.

MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition. Calculation of Delay Times. Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics. Calculation of Interconnect Delay. Switching Power Dissipation of CMOS Inverters.

Dynamic Logic Circuits : Introduction, Basic Principles of Pass Transistor Circuits. Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).

Low-Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low-Power Design Through Voltage Scaling. Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance, Adiabatic Logic Circuits.

BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation. Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.

Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits. Output Circuits and L(di/dt) Noise. On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.

Design for Manufacturability : Introduction, Process Variations, Basic Concepts and Definitions. Design of Experiments and Performance Modelling, Parametric Yield Estimation, Parametric Yield Maximization, Worst-Case Analysis, Performance Variability Minimization.

Reference Books:

1. Sung Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design". Tata McGraw-Hill, Third Edition.
2. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective". Second Edition. Pearson Education (Asia) Pvt. Ltd. 2000.

Advanced Embedded Systems

Subject Code : 14EVE13
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modeling; Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs.

Embedded Hardware Design and Development :EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation , PCB Layout Design – Building blocks, Component placement, PCB track routing.

ARM -32 bit Microcontroller family. Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture.

Embedded Firmware Design and Development: Embedded Firmware Design Approaches. Embedded Firmware Development Languages

Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/ELDompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Reference Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Newnes, (Elsevier), 2008.
3. James K Peckol, "Embedded Systems – A contemporary Design Tool", John Wiley, 2008.

Digital Circuits and Logic Design

Subject Code : 14ELLD14
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks

Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits, Fault-Location Experiments, Boolean Differences, Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic

Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities and Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.

Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, ELDompositions, Synthesis of Multiple Machines.

State—Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault-Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection Experiments for Machines which have no Distinguishing Sequences.

Reference Books:

1. Zvi Kohavi, “**Switching and Finite Automata Theory**”, 2nd Edition, Tata McGraw Hill Edition
2. Charles Roth Jr., “**Digital Circuits and logic Design**”,
3. Parag K Lala, “**Fault Tolerant And Fault Testable Hardware Design**”, Prentice Hall Inc. 1985
4. E. V. Krishnamurthy, “**Introductory Theory of Computer**”, Macmillan Press Ltd. 1983
5. Mishra & Chandrasekaran, “**Theory of computer science – Automata, Languages and Computation**”, 2nd Edition, PHI,2004

Digital System Design Using Verilog

Subject Code : EE11D151
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

Ex. Marks : 50
Exam Hours : 05
Exam Marks : 100

Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.

Combinational Basics: Boolean Functions and Boolean Algebra, Binary Coding, Combinational Components and Circuits, Verification of Combinational Circuits.

Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers.

Sequential Basics: Storage elements, Counters, Sequential Datapaths and Control, Clocked Synchronous Timing Methodology.

Memories: Concepts, Memory Types, Error Detection and Correction.

Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.

Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory.

I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.

Accelerators: Concepts, case study, Verification of accelerators.

Design Methodology: Design flow, Design optimization, Design for test.

REFERENCE BOOKS:

1. Peter J. Ashenden, "Digital Design: An Embedded Ssystems Approach Using VERILOG". Elsevier, 2010.

Digital Electronics Lab -1

Subject Code : 14ELD16
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

Design Using Cadence ORCAD

1. Design of 3½ Digit Digital Voltmeter
2. Design of Monolithic function Generator.
3. Design of Regulator Power supplies.
4. Design of Batch counter using TTL ICs.
5. Design of DAC and ADC.
6. Design of Electronic P, PI, PID and ON/OFF controllers.
7. Design of Programmable Timers.
8. Design of filters and resonance circuits.

VLSI DIGITAL DESIGN

FPGA DIGITAL DESIGN

VLSI Front End Design programs:

Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro apart from verification by simulation with any of the front end tools

1. Write Verilog code for the design of 8-bit
 - i. Carry Ripple Adder
 - ii. Carry LookAhead adder
 - iii. Carry Skip Adder

- iv. BCD Adder & Subtractor
 - 2. Write Verilog Code for 8-bit
 - i. Array Multiplication (Signed and Unsigned)
 - ii. Booth Multiplication (Radix-4)
 - 3. Write Verilog code for 4/8-bit
 - i. Magnitude Comparator
 - ii. LFSR
 - iii. Parity Generator
 - iv. Universal Shift Register
 - 4. Write Verilog Code for 3-bit Arbitrary Counter to generate 0,1,2,3,6,5,7 and repeats.
 - 5. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence.
Eg 11101 (with and without overlap) any sequence can be specified
 - 6. Design a FIFO and LIFO buffers in Verilog and Verify its Operation.
 - 7. Design a coin operated public Telephone unit using Mealy FSM model with following operations
 - i. The calling process is initiated by lifting the receiver.
 - ii. Insert 1 Rupee Coin to make a call.
 - iii. If line is busy, placing the receiver on hook should return a coin
 - iv. If line is through, the call is allowed for 60 seconds at the 45th second prompt another 1 Rupee coin to be inserted, to continue the call.
 - v. If user doesn't insert the coin within 60 seconds the call should be terminated.
 - vi. The system is ready to accept new call request when the receiver is placed on the hook.
 - vii. The FSM goes 'out of order' state when there is a Line Fault.
- Note: Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits

Modern DSP

Subject Code : 14EEED21
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 20
Exam Hours : 03
Exam Marks : 100

Goal of the course – Advances in Digital Signal Processing involve variable sampling rates and thus the multirate signal processing and hence their applications in communication systems and signal processing. It is intended to introduce a basic course in multirate signal processing especially meant for students of branches eligible for M Tech courses in EC related disciplines.

Introduction and Discrete Fourier Transforms: Signals, Systems and Processing. Classification of Signals, The Concept of Frequency in Continuous-Time and Discrete-Time Signals, Analog-to-Digital and Digital-to-Analog Conversion, Frequency-Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods Based on the DFT (Ref.1 Chap. 1 & 7)

Design of Digital Filters: General Considerations, Design of FIR Filters, Design of IIR Filters from Analog Filters. Frequency Transformations. (Ref.1 Chap.10)

Multirate Digital Signal Processing: Introduction, EL Dimation by a factor 'D', Interpolation by a factor 'I', Sampling rate Conversion by a factor 'I/D', implementation of Sampling rate conversion, Multistage implementation of Sampling rate conversion. Sampling rate conversion of Band Pass Signals, Sampling rate conversion by an arbitrary factor, Applications of Multirate Signal Processing, Digital Filter banks. Two Channel Quadrature Mirror Filter banks, M-Channel QMF bank. (Ref.1 Chap.11)

Adaptive Filters: Applications of Adaptive Filters, Adaptive Direct Form FIR Filters- The LMS Algorithm. Adaptive Direct Form Filters-RLS Algorithm. (Ref.1 Chap.13)

Reference Books:

1. Proakis and Manolakis, “**Digital Signal Processing**”, Prentice Hall 1996. (Fourth Edition).
2. Roberto Cristi, “**Modern Digital Signal Processing**”, Cengage Publishers, India, (Erstwhile Thompson Publications). 2003.
3. S.K. Mitra, “**Digital Signal Processing: A Computer Based Approach**”, III Ed, Tata McGraw Hill, India, 2007.
4. E.C. Ifeachor and B W Jarvis, “**Digital Signal Processing, a practitioners approach.**” II Edition, Pearson Education. India. 2002 Reprint.

Coding Theory

Subject Code : 14E1D22
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Information and Entropy: Sources of information, DMS and Markov. Properties of Entropy. Entropy of information sources. Extension of a DMS. Information channels. probability relations in a channel, A Priori, A Posteriori Entropies. Equivocation. Mutual information. Capacity of BSC, BEC, Noiseless and deterministic channels.

Source coding: Uniquely Decodable codes, Instantaneous codes and its construction, Average length of a code. Bounds for Average Length, Kraft's Inequality. R-ary compact codes. Code efficiency, Redundancy. Shannon-Fano and Huffman code.

Algebra: Groups, rings and fields, properties of finite fields, Galois field arithmetic and its realization, Vector spaces. Matrices.

Channel Coding: Block codes, Minimum distance of a block code, Singleton bound. Performance of Codes. Hamming codes. Cyclic codes. Golay Codes BCH codes, R-S codes. Convolutional codes. Viterbi Algorithm. LDPC Codes.

Reference Books:

1. S. Lin and D. J. Costello Jr, "Error Control Coding", Pearson Prentice Hall, 2004
2. T. K. Moon, "Error Correction Coding: Mathematical Methods And Algorithms". Student Edition. John Wiley & Sons, 2005

Digital Signal Compression

Subject Code : 14EED23
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction: Compression techniques, Modeling & coding, Distortion criteria, Differential Entropy, Rate Distortion Theory, Vector Spaces, Information theory, Models for sources, Coding – uniquely ELDecodable codes, Prefix codes, Kraft McMillan Inequality

Quantization: Quantization problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization, Entropy coded Quantization, Vector Quantization, LBG algorithm, Tree-structured VQ, Structured VQ, Variations of VQ – Gain shape VQ, Mean removed VQ, Classified VQ, Multistage VQ, Adaptive VQ, Trellis coded quantization

Differential Encoding: Basic algorithm, Prediction in DPCM, Adaptive DPCM, Delta Modulation, Speech coding – G.726, Image coding.

Transform Coding: Transforms – KLT, DCT, DST, DWHT; Quantization and coding of transform coefficients, Application to Image compression – JPEG, Application to audio compression.

Sub-band Coding: Filters, Sub-band coding algorithm, Design of filter banks, Perfect reconstruction using two channel filter banks, M-band QMF filter banks, Poly-phase ELDecomposition, Bit allocation, Speech coding – G.722, Audio coding – MPEG audio, Image compression

Wavelet Based Compression: Wavelets, Multiresolution analysis & scaling function, Implementation using filters, Image compression – EZW, SPIHT, JPEG 2000

Analysis/Synthesis Schemes: Speech compression – LPC-10, CELP, MELP, Image Compression – Fractal compression

Video Compression: Motion compensation, Video signal representation, Algorithms for video conferencing & videophones – H.261, H. 263, Asymmetric applications – MPEG 1, MPEG 2, MPEG 4, MPEG 7, Packet video

Lossless Coding: Huffman coding, Adaptive Huffman coding, Golomb codes, Rice codes, Tunstall codes, Applications of Huffman coding, Arithmetic coding, Algorithm implementation, Applications of Arithmetic coding, Dictionary techniques – LZ77, LZ78, Applications of LZ78 – JBIG, JBIG2, Predictive coding – Prediction with partial match, Burrows Wheeler Transform, Applications – CALIC, JPEG-LS, Facsimile coding – T.4, T.6.

Reference Books:

1. K. Sayood, "Introduction to Data Compression," Harcourt India Pvt. Ltd. & Morgan Kaufmann Publishers, 1996.
2. N. Jayant and P. Noll, "Digital Coding of Waveforms: Principles and Applications to Speech and Video," Prentice Hall, USA, 1984.
3. D. Salomon, "Data Compression: The Complete Reference", Springer, 2000.
4. Z. Li and M.S. Drew, "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

Real Time Operating Systems

Subject Code : 14111D24
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

- Introduction to Real-Time Embedded Systems:** Brief history of Real Time Systems. A brief history of Embedded Systems.
- System Resources:** Resource Analysis. Real-Time Service Utility. Scheduling Classes. The Cyclic Executive. Scheduler Concepts. Preemptive Fixed Priority Scheduling Policies, Real-Time OS. Thread Safe Reentrant Functions.
- Processing:** Preemptive Fixed-Priority Policy. Feasibility. Rate Monotonic least upper bound. Necessary and Sufficient feasibility. Deadline – Monotonic Policy, Dynamic priority policies.
- I/O Resources:** Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.
- Memory:** Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.
- Multi-resource Services:** Blocking, Deadlock and livelock, Critical sections to protect shared resources, priority inversion.
- Soft Real-Time Services:** Missed Deadlines, QoS, Alternatives to rate monotonic policy. Mixed hard and soft real-time services.
- Embedded System Components:** Firmware components, RTOS system software mechanisms. Software application components.
- Debugging Components:** Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports. Trace ports. Power-On self test and diagnostics, External test equipment, Application-level debugging.
- Performance Tuning:** Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software. Path length, Efficiency, and Call frequency, Fundamental optimizations.
- High availability and Reliability Design:** Reliability and Availability, Similarities and differences. Reliability. Reliable software. Available software. Design tradeoffs, Hierarchical applications for Fail-safe design.
- Design of RTOS – PIC microcontroller.** (Chap 13 of book MykePredko)

Reference Books:

1. Sam Stewert, "Real-Time Embedded Systems and Components", Cengage Learning India Edition, 2007.
2. Myke Predko, "Programming and Customizing the PIC microcontroller" 3rd Ed. TMH, 2008.
3. Dreamtech Software Team, "Programming for Embedded Systems", Jhon Wiley, India Pvt. Ltd., 2008.

Synthesis and Optimization of Digital Circuits

Subject Code : 14LE0252
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

- Introduction:** Microelectronics, semiconductor technologies and circuit taxonomy. Microelectronic design styles, computer aided synthesis and optimization.
- Graphs:** Notation, undirected graphs, directed graphs, combinatorial optimization. Algorithms, tractable and intractable problems, algorithms for linear and integer programs, graph optimization problems and algorithms. *Boolean algebra and Applications.*
- Hardware Modeling:** Hardware Modeling Languages, distinctive features, structural hardware language, Behavioural hardware language, HDLs used in synthesis, abstract models, structures logic networks, state diagrams, dataflow and sequencing graphs, compilation and optimization techniques.
- Two Level Combinational Logic Optimization:** Logic optimization, principles, operation on two level logic covers, algorithms for logic minimization, symbolic minimization and encoding property, minimization of Boolean relations.
- Multiple Level Combinational Optimizations:** Models and transformations for combinational networks, algebraic model, Synthesis of testable network, algorithm for delay evaluation and optimization, rule based system for logic optimization.
- Sequential Circuit Optimization:** Sequential circuit optimization using state based models, sequential circuit optimization using network models.
- Schedule Algorithms:** A model for scheduling problems, Scheduling wither source and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits.
- Cell Library Binding:** Problem formulation and analysis, algorithms for library binding, specific problems and algorithms for library binding (lookup table F.P.G.As and Anti fuse based F.P.G.As), rule based library binding.
- Testing:** Simulation, Types of simulators, basic components of a simulator, fault simulation Techniques, Automatic test pattern generation methods (ATPG), design for Testability (DFT) Techniques.

Reference Books:

1. Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits", Tata McGraw-Hill, 2003.
2. Srinivas Devadas, Abhijit Ghosh, and Kurt Keutzer, "Logic Synthesis", McGraw-Hill, USA, 1994.
3. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective", 2nd edition, Pearson Education (Asia) Pte. Ltd., 2000.
4. Kevin Skahill, "VHDL for Programmable Logic", Pearson Education (Asia) Pvt. Ltd., 2000.

Digital Electronics Lab -2

Subject Code : 1411D26
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Graphical Programming using LabVIEW

Design of 4 bit Adders (CLA, CSA, CMA, Parallel adders)

Design of Binary Subtractors

Design of Encoder (8X3), ELDecoder(3X8)

Design of Multiplexer (8X1), and Demultiplexer (1X8)

Design of code converters & Comparator

Design of FF (SR, D, T, JK, and Master Slave with delays)

Design of registers using latches and flip-flops

Design of 8 bit Shift registers

Design of Asynchronous & Synchronous Counters

ARM-CORTEX M3

[Programming to be done using Keiluvision 4 and download the program on to a M3 evaluation board such as NXP LPC1114 or ATMEL ATSAM3U].

Write an Assembly language program to calculate $10+9+8+\dots+1$

Write a Assembly language program to link Multiple object files and link them together.

Write a Assembly language program to store data in RAM.

Write a C program to Output the "Hello World" message using UART.

Write a C program to Design a Stopwatch using interrupts.

Write an Exception vector table in C

Write an Assembly Language Program for locking a Mutex.

Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values.

Advanced Computer Architecture

Subject Code : 14ELD41
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction and Review of Fundamentals of Computer Design: Introduction: Classes computers: Defining computer architecture: Trends in Technology: Trends in power in Integrated Circuits; Trends in cost: Dependability. Measuring, reporting and summarizing Performance: Quantitative Principles of computer design; Performance and Price-Performance; Fallacies and pitfalls: Case studies.

Some topics in Pipelining. Instruction –Level Parallelism, Its Exploitation and Limits on ILP: Introduction to pipelining. ILP: Crosscutting issues, fallacies, and pitfalls with respect to pipelining; Basic concepts and challenges of ILP: Case study of Pentium 4, Fallacies and pitfalls. Introduction to limits in ILP; Performance and efficiency in advanced multiple-issue processors.

Memory Hierarchy Design, Storage Systems: Review of basic concepts; Crosscutting issues in the design of memory hierarchies: Case study of AMD Opteron memory hierarchy; Fallacies and pitfalls in the design of memory hierarchies. Introduction to Storage Systems: Advanced topics in disk storage.

Definition and examples of real faults and failures ; I/O performance, reliability measures, and benchmarks: Queuing theory: Crosscutting issues; Designing and evaluating an I/O system – The Internet archive cluster; Case study of NetAA FAS6000 filer: Fallacies and pitfalls.

Hardware and Software for VLIW and EPIC Introduction: Exploiting Instruction-Level Parallelism Statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor.

Concluding Remarks.

Large-Scale Multiprocessors and Scientific Applications Introduction, Interprocessor Communication: The Critical Performance Issue, Characteristics of Scientific Applications, Synchronization: Scaling Up, Performance of Scientific Applications on Shared-Memory Multiprocessors, Performance Measurement of Parallel Processors with Scientific Applications, Implementing Cache Coherence. The Custom Cluster Approach: Blue Gene/L, Concluding Remarks.

Computer Arithmetic: Introduction, Basic Techniques of Integer Arithmetic, Floating Point, Floating-Point Multiplication, Floating-Point Addition, Division and Remainder, More on Floating-Point Arithmetic, Speeding Up Integer Addition, Speeding Up Integer Multiplication and Division, Fallacies and Pitfalls.

Reference Books:

1. Hennessey and Patterson. "**Computer Architecture A Quantitative Approach**". 4th Edition. Elsevier. 2007.
2. Kai Hwang. "**Advanced Computer Architecture - Parallelism, Scalability, Programmability**". 2nd Edition

Advances in VLSI Design

Subject Code : 14EVE421
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS.

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS.

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nanotubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic. Defect tolerant computing,

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks -NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR- NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module layout.

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom design.

Reference Books:

1. Kevin F Brennan "Introduction to Semi Conductor Device", Cambridge publications
2. Eugene D Fabricius "Introduction to VLSI Design", McGraw-Hill International publications
3. D.APucknell "Basic VLSI Design", PHI Publication

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD11	Advanced Mathematics	4	2	3	50	100	150	4
14EVE12	Digital VLSI Design	4	2	3	50	100	150	4
14EVE13	Advanced Embedded Systems	4	2	3	50	100	150	4
14ELD14	Digital Circuits and Logic Design	4	2	3	50	100	150	4
14ELD15X	Elective - I	4	2	3	50	100	150	4
14ELD16	Digital Electronics Lab -I	--	3	3	25	50	75	2
14ELD17	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective-1

14 ELD 151	Digital System Design using Verilog	1
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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. Digital Electronics

II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD21	Modern DSP	4	2	3	50	100	150	4
14ELD22	Coding Theory	4	2	3	50	100	150	4
14ELD23	Digital Signal Compression	4	2	3	50	100	150	4
14ELD24	Real Time Operating Systems	4	2	3	50	100	150	4
14ELD25X	Elective-2	4	2	3	50	100	150	4
14ELD26	Digital Electronics Lab -2		3	3	25	50	75	2
14ELD27	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
**Project Phase-I(6 week Duration)								
Total		20	16	18	300	550	850	23

Elective -2:

14 ELD 252	Synthesis & Optimization of Digital Circuits
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** Between the II Semester and III Semester, after availing a vocation of 2 weeks.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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M.Tech. Digital Electronics

III Semester: INTERNSHIP #

CREDIT BASED

Course Code	Subject	Teaching hours/week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14ELD31	Midterm Presentation on Internship (After 8 weeks from the date of commencement) *	-	-	-	25	-	25	1
14ELD32	Report on Internship (After 16 weeks from the date of commencement)	-	-	-	75		75	15
14ELD33	Evaluation and Viva-voce	-	-	3	-	50	50	4
	Total	-	-	-	100	50	150	20

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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M.Tech. Digital Electronics

IV Semester

CREDIT BASED

Subject Code	Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment / Tutorials		LA.	Exam		
14ELD41	Advanced Computer Architecture	4	2	3	50	100	150	4
14ELD42X	Elective-3	4	2	3	50	100	150	4
14ELD43	Evaluation of Project Phase-I	-	-	-	25	-	25	1
14ELD44	Phase-II : Midterm evaluation of Project	-	-	-	25	-	25	1
<u>14ELD45</u>	Evaluation of Project Work and Viva-voce	-	-	3	-	100+100	200	18
Total		8	04	09	150	400	550	28
Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits								

Elective -3:

14 EVE 421	Advances in VLSI Design
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Note:

- 1) Project Phase - I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carry out literature survey & visit to Industries to finalize the topic of dissertation.
- 2) Project Phase - II: 16 weeks duration during III Semester. Evaluation shall be taken during the Second week of the IV Semester. Total Marks shall be 25.
- 3) Project Evaluation: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 250 (Phase I Evaluation: 25 Marks, Phase -II Evaluation: 25 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase - I & II shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (Out of two external examiners at least one should be present).

Advanced Mathematics

Subject Code	: 14ELD11	IA Marks	: 50
No. of Lecture Hours / Week	: 04	Exam. Hours	: 03
Total No. of Lecture Hours	: 50	Exam. Marks	: 100

Matrix Theory

QR-EL Decomposition – Eigen values using shifted QR algorithm- Singular Value EL Decomposition - Pseudo inverse- Least square approximations

Calculus of Variations

Concept of Functionals- Euler's equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso perimetric problems- Variational problems with moving boundaries

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of a elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi infinite rod.

Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions

Reference Books:

1. Richard Bronson, "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
2. Venkataraman M K, "Higher Engineering Mathematics", National Pub. Co, 1992
3. Elsgolts, I., "Differential Equations and Calculus of Variations", Mir, 1977.
4. Sneddon, I.N., "Elements of Partial differential equations", Dover Publications, 2006.
5. Sankara Rao, K., "Introduction to partial differential equations", Prentice - Hall of India, 1995
6. Taha H A, "Operations research - An introduction", McMilan Publishing co, 1982.

Digital VLSI Design

Subject Code : 14EVE12
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure. The MOS System under External Bias. Structure and Operation of MOS Transistor. MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.

MOS Inverters: Static Characteristics: Introduction, Resistive-Load Inverter. Inverters with n_Type MOSFET Load. CMOS Inverter.

MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition. Calculation of Delay Times. Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics. Calculation of Interconnect Delay. Switching Power Dissipation of CMOS Inverters.

Dynamic Logic Circuits : Introduction, Basic Principles of Pass Transistor Circuits. Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).

Low-Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low-Power Design Through Voltage Scaling. Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance, Adiabatic Logic Circuits.

BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation. Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.

Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits. Output Circuits and L(di/dt) Noise. On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.

Design for Manufacturability : Introduction, Process Variations, Basic Concepts and Definitions. Design of Experiments and Performance Modelling, Parametric Yield Estimation, Parametric Yield Maximization, Worst-Case Analysis, Performance Variability Minimization.

Reference Books:

1. Sung Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design". Tata McGraw-Hill, Third Edition.
2. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective". Second Edition. Pearson Education (Asia) Pvt. Ltd. 2000.

Advanced Embedded Systems

Subject Code : 14EVE13
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modeling; Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs.

Embedded Hardware Design and Development :EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation , PCB Layout Design – Building blocks, Component placement, PCB track routing.

ARM -32 bit Microcontroller family. Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture.

Embedded Firmware Design and Development: Embedded Firmware Design Approaches. Embedded Firmware Development Languages

Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/ELDompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Reference Books:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Newnes, (Elsevier), 2008.
3. James K Peckol, "Embedded Systems – A contemporary Design Tool", John Wiley, 2008.

Digital Circuits and Logic Design

Subject Code : 14ELLD14
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks

Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits, Fault-Location Experiments, Boolean Differences, Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic

Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities and Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.

Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, ELDompositions, Synthesis of Multiple Machines.

State—Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault-Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection Experiments for Machines which have no Distinguishing Sequences.

Reference Books:

1. Zvi Kohavi, “**Switching and Finite Automata Theory**”, 2nd Edition, Tata McGraw Hill Edition
2. Charles Roth Jr., “**Digital Circuits and logic Design**”.
3. Parag K Lala, “**Fault Tolerant And Fault Testable Hardware Design**”, Prentice Hall Inc. 1985
4. E. V. Krishnamurthy, “**Introductory Theory of Computer**”, Macmillan Press Ltd. 1983
5. Mishra & Chandrasekaran, “**Theory of computer science – Automata, Languages and Computation**”, 2nd Edition, PHI.2004

Digital System Design Using Verilog

Subject Code : EE11D151
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

Ex. Marks : 50
Exam Hours : 05
Exam Marks : 100

Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.

Combinational Basics: Boolean Functions and Boolean Algebra, Binary Coding, Combinational Components and Circuits, Verification of Combinational Circuits.

Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers.

Sequential Basics: Storage elements, Counters, Sequential Datapaths and Control, Clocked Synchronous Timing Methodology.

Memories: Concepts, Memory Types, Error Detection and Correction.

Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.

Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory.

I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.

Accelerators: Concepts, case study, Verification of accelerators.

Design Methodology: Design flow, Design optimization, Design for test.

REFERENCE BOOKS:

1. Peter J. Ashenden, "Digital Design: An Embedded Ssystems Approach Using VERILOG". Elsevier, 2010.

Digital Electronics Lab -1

Subject Code : 14ELD16
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

Design Using Cadence ORCAD

1. Design of 3½ Digit Digital Voltmeter
2. Design of Monolithic function Generator.
3. Design of Regulator Power supplies.
4. Design of Batch counter using TTL ICs.
5. Design of DAC and ADC.
6. Design of Electronic P, PI, PID and ON/OFF controllers.
7. Design of Programmable Timers.
8. Design of filters and resonance circuits.

VLSI DIGITAL DESIGN

FPGA DIGITAL DESIGN

VLSI Front End Design programs:

Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro apart from verification by simulation with any of the front end tools

1. Write Verilog code for the design of 8-bit
 - i. Carry Ripple Adder
 - ii. Carry LookAhead adder
 - iii. Carry Skip Adder

- iv. BCD Adder & Subtractor
 - 2. Write Verilog Code for 8-bit
 - i. Array Multiplication (Signed and Unsigned)
 - ii. Booth Multiplication (Radix-4)
 - 3. Write Verilog code for 4/8-bit
 - i. Magnitude Comparator
 - ii. LFSR
 - iii. Parity Generator
 - iv. Universal Shift Register
 - 4. Write Verilog Code for 3-bit Arbitrary Counter to generate 0,1,2,3,6,5,7 and repeats.
 - 5. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence.
Eg 11101 (with and without overlap) any sequence can be specified
 - 6. Design a FIFO and LIFO buffers in Verilog and Verify its Operation.
 - 7. Design a coin operated public Telephone unit using Mealy FSM model with following operations
 - i. The calling process is initiated by lifting the receiver.
 - ii. Insert 1 Rupee Coin to make a call.
 - iii. If line is busy, placing the receiver on hook should return a coin
 - iv. If line is through, the call is allowed for 60 seconds at the 45th second prompt another 1 Rupee coin to be inserted, to continue the call.
 - v. If user doesn't insert the coin within 60 seconds the call should be terminated.
 - vi. The system is ready to accept new call request when the receiver is placed on the hook.
 - vii. The FSM goes 'out of order' state when there is a Line Fault.
- Note: Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits

Modern DSP

Subject Code : 14EEED21
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 20
Exam Hours : 03
Exam Marks : 100

Goal of the course – Advances in Digital Signal Processing involve variable sampling rates and thus the multirate signal processing and hence their applications in communication systems and signal processing. It is intended to introduce a basic course in multirate signal processing especially meant for students of branches eligible for M Tech courses in EC related disciplines.

Introduction and Discrete Fourier Transforms: Signals, Systems and Processing. Classification of Signals, The Concept of Frequency in Continuous-Time and Discrete-Time Signals, Analog-to-Digital and Digital-to-Analog Conversion, Frequency-Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods Based on the DFT (Ref.1 Chap. 1 & 7)

Design of Digital Filters: General Considerations, Design of FIR Filters, Design of IIR Filters from Analog Filters. Frequency Transformations. (Ref.1 Chap.10)

Multirate Digital Signal Processing: Introduction, EL Dimation by a factor 'D', Interpolation by a factor 'I', Sampling rate Conversion by a factor 'I/D', implementation of Sampling rate conversion, Multistage implementation of Sampling rate conversion. Sampling rate conversion of Band Pass Signals, Sampling rate conversion by an arbitrary factor, Applications of Multirate Signal Processing, Digital Filter banks. Two Channel Quadrature Mirror Filter banks, M-Channel QMF bank. (Ref.1 Chap.11)

Adaptive Filters: Applications of Adaptive Filters, Adaptive Direct Form FIR Filters- The LMS Algorithm. Adaptive Direct Form Filters-RLS Algorithm. (Ref.1 Chap.13)

Reference Books:

1. Proakis and Manolakis, "Digital Signal Processing", Prentice Hall 1996. (Fourth Edition).
2. Roberto Cristi, "Modern Digital Signal Processing", Cengage Publishers, India, (Erstwhile Thompson Publications). 2003.
3. S.K. Mitra, "Digital Signal Processing: A Computer Based Approach", III Ed, Tata McGraw Hill, India, 2007.
4. E.C. Ifeachor and B W Jarvis, "Digital Signal Processing, a practitioners approach." II Edition, Pearson Education. India. 2002 Reprint.

Coding Theory

Subject Code : 14E1D22
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Information and Entropy: Sources of information, DMS and Markov. Properties of Entropy. Entropy of information sources. Extension of a DMS. Information channels. probability relations in a channel, A Priori, A Posteriori Entropies. Equivocation. Mutual information. Capacity of BSC, BEC, Noiseless and deterministic channels.

Source coding: Uniquely Decodable codes, Instantaneous codes and its construction, Average length of a code. Bounds for Average Length, Kraft's Inequality. R-ary compact codes. Code efficiency, Redundancy. Shannon-Fano and Huffman code.

Algebra: Groups, rings and fields, properties of finite fields, Galois field arithmetic and its realization, Vector spaces. Matrices.

Channel Coding: Block codes, Minimum distance of a block code, Singleton bound. Performance of Codes. Hamming codes. Cyclic codes. Golay Codes BCH codes, R-S codes. Convolutional codes. Viterbi Algorithm. LDPC Codes.

Reference Books:

1. S. Lin and D. J. Costello Jr, "Error Control Coding", Pearson Prentice Hall, 2004
2. T. K. Moon, "Error Correction Coding: Mathematical Methods And Algorithms". Student Edition. John Wiley & Sons, 2005

Digital Signal Compression

Subject Code : 14EED23
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction: Compression techniques, Modeling & coding, Distortion criteria, Differential Entropy, Rate Distortion Theory, Vector Spaces, Information theory, Models for sources, Coding – uniquely ELDecodable codes, Prefix codes, Kraft McMillan Inequality

Quantization: Quantization problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization, Entropy coded Quantization, Vector Quantization, LBG algorithm, Tree-structured VQ, Structured VQ, Variations of VQ – Gain shape VQ, Mean removed VQ, Classified VQ, Multistage VQ, Adaptive VQ, Trellis coded quantization

Differential Encoding: Basic algorithm, Prediction in DPCM, Adaptive DPCM, Delta Modulation, Speech coding – G.726, Image coding.

Transform Coding: Transforms – KLT, DCT, DST, DWHT; Quantization and coding of transform coefficients, Application to Image compression – JPEG, Application to audio compression.

Sub-band Coding: Filters, Sub-band coding algorithm, Design of filter banks, Perfect reconstruction using two channel filter banks, M-band QMF filter banks, Poly-phase ELDecomposition, Bit allocation, Speech coding – G.722, Audio coding – MPEG audio, Image compression

Wavelet Based Compression: Wavelets, Multiresolution analysis & scaling function, Implementation using filters, Image compression – EZW, SPIHT, JPEG 2000

Analysis/Synthesis Schemes: Speech compression – LPC-10, CELP, MELP, Image Compression – Fractal compression

Video Compression: Motion compensation, Video signal representation, Algorithms for video conferencing & videophones – H.261, H. 263, Asymmetric applications – MPEG 1, MPEG 2, MPEG 4, MPEG 7, Packet video

Lossless Coding: Huffman coding, Adaptive Huffman coding, Golomb codes, Rice codes, Tunstall codes, Applications of Huffman coding, Arithmetic coding, Algorithm implementation, Applications of Arithmetic coding, Dictionary techniques – LZ77, LZ78, Applications of LZ78 – JBIG, JBIG2, Predictive coding – Prediction with partial match, Burrows Wheeler Transform, Applications – CALIC, JPEG-LS, Facsimile coding – T.4, T.6.

Reference Books:

1. K. Sayood, "Introduction to Data Compression," Harcourt India Pvt. Ltd. & Morgan Kaufmann Publishers, 1996.
2. N. Jayant and P. Noll, "Digital Coding of Waveforms: Principles and Applications to Speech and Video," Prentice Hall, USA, 1984.
3. D. Salomon, "Data Compression: The Complete Reference", Springer, 2000.
4. Z. Li and M.S. Drew, "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

Real Time Operating Systems

Subject Code : 1411D24
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

- Introduction to Real-Time Embedded Systems:** Brief history of Real Time Systems. A brief history of Embedded Systems.
- System Resources:** Resource Analysis. Real-Time Service Utility. Scheduling Classes. The Cyclic Executive. Scheduler Concepts. Preemptive Fixed Priority Scheduling Policies, Real-Time OS. Thread Safe Reentrant Functions.
- Processing:** Preemptive Fixed-Priority Policy. Feasibility. Rate Monotonic least upper bound. Necessary and Sufficient feasibility. Deadline – Monotonic Policy, Dynamic priority policies.
- I/O Resources:** Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.
- Memory:** Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.
- Multi-resource Services:** Blocking, Deadlock and livelock, Critical sections to protect shared resources, priority inversion.
- Soft Real-Time Services:** Missed Deadlines, QoS, Alternatives to rate monotonic policy. Mixed hard and soft real-time services.
- Embedded System Components:** Firmware components, RTOS system software mechanisms. Software application components.
- Debugging Components:** Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports. Power-On self test and diagnostics, External test equipment, Application-level debugging.
- Performance Tuning:** Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software. Path length, Efficiency, and Call frequency, Fundamental optimizations.
- High availability and Reliability Design:** Reliability and Availability, Similarities and differences. Reliability. Reliable software, Available software. Design tradeoffs, Hierarchical applications for Fail-safe design.
- Design of RTOS – PIC microcontroller.** (Chap 13 of book MykePredko)

Reference Books:

1. Sam Stewert, "Real-Time Embedded Systems and Components", Cengage Learning India Edition, 2007.
2. Myke Predko, "Programming and Customizing the PIC microcontroller" 3rd Ed. TMH, 2008.
3. Dreamtech Software Team, "Programming for Embedded Systems", Jhon Wiley, India Pvt. Ltd., 2008.

Synthesis and Optimization of Digital Circuits

Subject Code : 14LE0252
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

- Introduction:** Microelectronics, semiconductor technologies and circuit taxonomy. Microelectronic design styles, computer aided synthesis and optimization.
- Graphs:** Notation, undirected graphs, directed graphs, combinatorial optimization. Algorithms, tractable and intractable problems, algorithms for linear and integer programs, graph optimization problems and algorithms. *Boolean algebra and Applications.*
- Hardware Modeling:** Hardware Modeling Languages, distinctive features, structural hardware language, Behavioural hardware language, HDLs used in synthesis, abstract models, structures logic networks, state diagrams, dataflow and sequencing graphs, compilation and optimization techniques.
- Two Level Combinational Logic Optimization:** Logic optimization, principles, operation on two level logic covers, algorithms for logic minimization, symbolic minimization and encoding property, minimization of Boolean relations.
- Multiple Level Combinational Optimizations:** Models and transformations for combinational networks, algebraic model, Synthesis of testable network, algorithm for delay evaluation and optimization, rule based system for logic optimization.
- Sequential Circuit Optimization:** Sequential circuit optimization using state based models, sequential circuit optimization using network models.
- Schedule Algorithms:** A model for scheduling problems, Scheduling wither source and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits.
- Cell Library Binding:** Problem formulation and analysis, algorithms for library binding, specific problems and algorithms for library binding (lookup table F.P.G.As and Anti fuse based F.P.G.As), rule based library binding.
- Testing:** Simulation, Types of simulators, basic components of a simulator, fault simulation Techniques, Automatic test pattern generation methods (ATPG), design for Testability (DFT) Techniques.

Reference Books:

1. Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits", Tata McGraw-Hill, 2003.
2. Srinivas Devadas, Abhijit Ghosh, and Kurt Keutzer, "Logic Synthesis", McGraw-Hill, USA, 1994.
3. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective", 2nd edition, Pearson Education (Asia) Pte. Ltd., 2000.
4. Kevin Skahill, "VHDL for Programmable Logic", Pearson Education (Asia) Pvt. Ltd., 2000.

Digital Electronics Lab -2

Subject Code : 1411D26
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Graphical Programming using LabVIEW

Design of 4 bit Adders (CLA, CSA, CMA, Parallel adders)

Design of Binary Subtractors

Design of Encoder (8X3), ELDecoder(3X8)

Design of Multiplexer (8X1), and Demultiplexer (1X8)

Design of code converters & Comparator

Design of FF (SR, D, T, JK, and Master Slave with delays)

Design of registers using latches and flip-flops

Design of 8 bit Shift registers

Design of Asynchronous & Synchronous Counters

ARM-CORTEX M3

[Programming to be done using Keiluvision 4 and download the program on to a M3 evaluation board such as NXP LPC1114 or ATMEL ATSAM3U].

Write an Assembly language program to calculate $10+9+8+\dots+1$

Write a Assembly language program to link Multiple object files and link them together.

Write a Assembly language program to store data in RAM.

Write a C program to Output the "Hello World" message using UART.

Write a C program to Design a Stopwatch using interrupts.

Write an Exception vector table in C

Write an Assembly Language Program for locking a Mutex.

Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values.

Advanced Computer Architecture

Subject Code : 14ELD41
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction and Review of Fundamentals of Computer Design: Introduction: Classes computers: Defining computer architecture: Trends in Technology: Trends in power in Integrated Circuits; Trends in cost: Dependability. Measuring, reporting and summarizing Performance: Quantitative Principles of computer design; Performance and Price-Performance; Fallacies and pitfalls: Case studies.

Some topics in Pipelining. Instruction –Level Parallelism, Its Exploitation and Limits on ILP: Introduction to pipelining. ILP: Crosscutting issues, fallacies, and pitfalls with respect to pipelining; Basic concepts and challenges of ILP: Case study of Pentium 4, Fallacies and pitfalls. Introduction to limits in ILP; Performance and efficiency in advanced multiple-issue processors.

Memory Hierarchy Design, Storage Systems: Review of basic concepts; Crosscutting issues in the design of memory hierarchies: Case study of AMD Opteron memory hierarchy; Fallacies and pitfalls in the design of memory hierarchies. Introduction to Storage Systems: Advanced topics in disk storage.

Definition and examples of real faults and failures ; I/O performance, reliability measures, and benchmarks: Queuing theory: Crosscutting issues; Designing and evaluating an I/O system – The Internet archive cluster; Case study of NetAA FAS6000 filer: Fallacies and pitfalls.

Hardware and Software for VLIW and EPIC Introduction: Exploiting Instruction-Level Parallelism Statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor.

Concluding Remarks.

Large-Scale Multiprocessors and Scientific Applications Introduction, Interprocessor Communication: The Critical Performance Issue, Characteristics of Scientific Applications, Synchronization: Scaling Up, Performance of Scientific Applications on Shared-Memory Multiprocessors, Performance Measurement of Parallel Processors with Scientific Applications, Implementing Cache Coherence. The Custom Cluster Approach: Blue Gene/L, Concluding Remarks.

Computer Arithmetic: Introduction, Basic Techniques of Integer Arithmetic, Floating Point, Floating-Point Multiplication, Floating-Point Addition, Division and Remainder, More on Floating-Point Arithmetic, Speeding Up Integer Addition, Speeding Up Integer Multiplication and Division, Fallacies and Pitfalls.

Reference Books:

1. Hennessey and Patterson. "**Computer Architecture A Quantitative Approach**". 4th Edition. Elsevier. 2007.
2. Kai Hwang. "**Advanced Computer Architecture - Parallelism, Scalability, Programmability**". 2nd Edition

Advances in VLSI Design

Subject Code : 14EVE421
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS.

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS.

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nanotubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic. Defect tolerant computing,

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks -NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR- NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module layout.

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom design.

Reference Books:

1. Kevin F Brennan "Introduction to Semi Conductor Device", Cambridge publications
2. Eugene D Fabricius "Introduction to VLSI Design", McGraw-Hill International publications
3. D.APucknell "Basic VLSI Design", PHI Publication

**SCHEME OF TEACHING AND EXAMINATION
M.Tech in DIGITAL ELECTRONICS / ELECTRONICS**

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16ELD11	Advanced Engineering Mathematics	4	-	3	20	80	100	4
2	16EVE12	Digital VLSI Design	4	-	3	20	80	100	4
3	16EVE13	Advanced Embedded System	4	-	3	20	80	100	4
4	16ELD14	Digital Circuit and Logic Design	4	-	3	20	80	100	4
5	16EXX15X	Elective-1	3	-	3	20	80	100	3
6	16ELDL16	Digital Electronics Lab -1		3	3	20	80	100	2
7	16ELD17	Seminar on advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective-1	
16EVE151	Digital System Design using Verilog

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

II SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16ECS21	Advanced DSP	4	-	3	20	80	100	4
2	16ECS22	Error Control Coding	4	-	3	20	80	100	4
3	16EVE23	Advances in VLSI Design	4	-	3	20	80	100	4
4	16EVE24	Real Time Operating System	4	-	3	20	80	100	4
5	16EXX25X	Elective –2	3	-	3	20	80	100	3
6	16ELDL26	Digital Electronics Lab - 2		3	3	20	80	100	2
7	16ELD27	Seminar on Advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective-2	
16ECS252	Multimedia Over Communication Links

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

III SEMESTER: Internship

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16ELD31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16ELD32	Report on Internship	-	-	-	25	-	50	
3	16ELD33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16ELD34	Evaluation of Project phase -1	-	-	-	50	-	25	1
TOTAL			-	-	-	100	50	150	21

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16ELD41	Synthesis and optimization of Digital Circuits	4	-	3	20	80	100	4
2	16EXX42X	Elective-3	3	-	3	20	80	100	3
3	16ELD43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16ELD44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			-	-	6	90	360	450	20

Elective-3	
16ECS422	Advances in Image Processing

Note:

1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted .

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.Tech – DE & E - FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject Code	16ELD11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Acquaint with principles of linear algebra, calculus of variations, probability theory and random process. • Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>Linear Algebra-I Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank-Nullity theorem(without proof). Matrix form of linear transformations- Illustrative examples.(Text 1 & Ref. 1)</p>			L1,L2
Module -2			
<p>Linear Algebra-II Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations.(Text 1 & Ref. 1)</p>			L1,L2
Module -3			
<p>Calculus of Variations Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.(Text 2 & Ref. 2)</p>			L1,L2
Module -4			

<p>Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions-examples.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Module -5</p>	
<p>Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Statement of central limit theorem-Illustrative examples. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images. • Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems. • Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits. • Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications. • Apply the idea of joint probability distributions and the role of parameter-dependent random variables in random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, —Advanced Engineering Mathematics|| , 10th edition, Wiley, 2015.
3. Scott L.Miller, Donald G. Childers: —Probability and Random Process with application to Signal Processing|| , Elsevier Academic Press, 2nd Edition,2013.

Reference books:

1. Richard Bronson: —Schaum’s Outlines of Theory and Problems of Matrix Operations|| , McGraw-Hill, 1988.
2. Elsgolts, L.:|| Differential Equations and Calculus of Variations|| , MIR Publications, 3rd Edition, 1977.
3. T.Veerarajan: —Probability, Statistics and Random Process—,3rd Edition, Tata McGraw Hill Co.,2008.

Web links:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>
4. www.wolfram.com

DIGITAL VLSI DESIGN [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	16EVE12	IA Marks	20
Number	04	Exam Marks	80
Total Number of	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Explain VLSI Design Methodologies • Learn Static and Dynamic operation principles, analysis and design of inverter circuit. • Infer state of the art Semiconductors Memory circuits. • Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits. • Illustrate VLSI and ASIC design. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects. MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.			L1, L2
Module -2			
MOS Inverters-Static Characteristics: CMOS Inverter. MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.			L2, L3
Module -3			

<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>	<p>L1, L2, L3</p>
<p>Module -4</p>	
<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Sung Mo Kang & Yosuf Leblebici, –CMOS Digital Integrated Circuits: Analysis and Designll , Tata McGraw-Hill, Third Edition.</p>	

Reference Books:

1. Neil Weste and K. Eshragian, —Principles of CMOS VLSI Design: A System Perspective, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.
2. Wayne, Wolf, —Modern VLSI Design: System on Silicon, Prentice Hall PTR/Pearson Education, Second Edition, 1998.
3. Douglas A Pucknell & Kamran Eshragian , —Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).

ADVANCED EMBEDDED SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EVE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

Describe the hardware software co-design and firmware design approaches

Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.

Program ARM CORTEX M3 using the various instructions, for different applications.

Modules	Revised Bloom's Taxonomy (RBT) Level
Module -1	
Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).	L1, L2, L3
Module -2	
Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).	L1, L2, L3
Module -3	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)	L1, L2, L3

Module -4	
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6)	L1, L2, L3
Module -5	
Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. Explain the hardware software co-design and firmware design approaches. Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. ● Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, –The Definitive Guide to the ARM Cortex-M3, 2ndedn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

DIGITAL CIRCUITS AND LOGIC DESIGN			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject Code	16ELD14	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand the concepts of sequential machines ● Design Sequential Machines/Circuits ● Analyze the faults in the design of circuits ● Apply fault detection experiments to sequential circuits 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks, Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities.			L1, L2,L3
Module -2			
Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic, Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits.			L1, L2, L3,L4
Module -3			
Fault-Location Experiments, Boolean Differences, Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.			L1, L2, L3,L4
Module -4			
Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, ELD ecompositions, Synthesis of Multiple Machines.			L1, L2, L3,L4
Module -5			

<p>State Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection.</p>	<p>L1, L2, L3,L4</p>
<p>Course outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> ● Understand the concepts of sequential machines ● Design Sequential Machines/Circuits ● Analyze the faults in the design of circuits ● Apply fault detection experiments to sequential circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Zvi Kohavi, –Switching and Finite Automata Theoryll , 2nd Edition, TMH.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Charles Roth Jr., –Digital Circuits and logic Designll , 7thedn, Cengage Learning, 2014. 2. Parag K Lala, –Fault Tolerant And Fault Testable Hardware Designll , Prentice Hall Inc. 1985. 3. E. V. Krishnamurthy, –Introductory Theory of Computerll , Macmillan Press Ltd, 1983 4. Mishra & Chandrasekaran, –Theory of computer science – Automata, Languages and Computationll , 2nd Edition, PHI, 2004. 	

DIGITAL SYSTEM DESIGN USING VERILOG [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	16EVE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand the concepts of Verilog Language ● Design the digital systems as an activity in a larger systems design context. ● Study the design and operation of semiconductor memories frequently used in application specific digital system. ● Inspect how effectively IC's are embedded in package and assembled in PCB's for different application ● Design and diagnosis of processors and I/O controllers they can be used in embedded systems 			
Modules			Revised Bloom's Taxonomy (RBT)
Module -1			
Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.			L1, L2
Module -2			
Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers. Sequential Basics: Storage elements, Counters, Sequential Data paths and Control, Clocked Synchronous Timing Methodology.			L1, L2
Module -3			
Memories: Concepts, Memory Types, Error Detection and Correction. Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.			L1, L2
Module -4			
Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory. I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.			L2, L3
Module -5			

<p>Accelerators: Concepts, case study, Verification of accelerators. Design Methodology: Design flow, Design optimization, Design for test.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Design embedded systems, using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores. • Design construct the combinational circuits using discrete gates and programmable logic devices. • Describe Verilog model for sequential circuits and test pattern generation • Explore the different types of semiconductor memories and their usage for specific chip design • Synthesis different types of processor and I/O controllers that are used in embedded system design 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Peter J. Ashenden, –Digital Design: An Embedded Systems Approach Using VERILOG^{II}, Elsevier, 2010.</p>	
<p>Reference Book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Samir Palnitkar.</p>	

DIGITAL ELECTRONICS LAB -1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory Code	16ELDL16	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience on the

- Design tool such as Cadence OrCAD/ OrCAD Lite /EDA tool
- Design of analog and digital circuits using the simulation tool
- FPGA Design and testing for digital circuits
- Verilog programming and design of digital circuits
- Design, verification and performance testing

Laboratory Experiments**Revised Bloom's Taxonomy (RBT) Level****1. Using Cadence OrCAD or OrCAD Lite or any EDA Tool, design and verify the following:****L2,L3,L4**

- a) 3½ Digit Digital Voltmeter
- b) Monolithic function Generator
- c) Regulated Power supplies
- d) Batch counter using TTL ICs.
- e) DAC and ADC
- f) P, PI, PID and ON/OFF Controllers
- g) Programmable Timers
- h) Filters and Resonance Circuits

<p>2. Develop Verilog Program for design and testing the following digital circuits (for 4/8 bits) using FPGA/CPLD. Use logic analyzer/Chipscope for the verification of results.</p> <p>(Note: Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro. Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits.)</p> <ol style="list-style-type: none"> Carry skip and carry look ahead adder BCD adder and subtractor Array Multiplication (signed and unsigned) Booth multiplication (radix-4) Magnitude comparator LFSR Parity generator Universal Shift Register Sequence generation (11101 say) using Mealy/Moore FSM 	<p>L2, L3, L4</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Design an analog and digital systems using Cadence OrCAD, OrCAD Lite or any EDA tool. Develop Verilog Programs for Digital Circuit design simulation. Design and implement digital systems on FPGA/CPLD Testing and validation of digital systems using Logic analyzer/Chipscope 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments are to be included for practical examination. For examination, two questions using different tool to be set. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero. 	

M.Tech – DE & E - SECOND SEMESTER SYLLABUS

Advanced DSP			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16ECS21	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand Multirate digital signal processing principles and its applications. ● Estimate the various spectral components present in the received signal using different spectral estimation methods such as Parametric and Nonparametric. ● Design and implement an optimum adaptive filter using LMS and RLS algorithms. ● Understand the concepts and mathematical representations of Wavelet transforms. 			
Modules			RBT Level
Module 1			
<p>Multirate Digital Signal Processing: Introduction, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks, M-channel QMF bank. (Text 1)</p>			L1,L2,L3
Module 2			
<p>Linear prediction and Optimum Linear Filters: Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters. (Text 1)</p>			L1,L2,L3
Module 3			
<p>Adaptive filters: Applications of adaptive filters- Adaptive channel equalization,, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm. (Text 1)</p>			L1,L2,L3
Module 4			
<p>Power Spectrum Estimation: Non parametric Methods for Power Spectrum Estimation - Bartlett Method, Welch Method, Blackman and Tukey Methods. Parametric Methods for Power Spectrum Estimation: Relationship between the auto correlation and the model</p>			

parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, Unconstrained least-squares method for the AR Model parameters, Sequential estimation methods for the AR Model parameters, ARMA Model for Power Spectrum Estimation. (Text 1)	L1,L2,L3
Module 5	
<p>WAVELET TRANSFORMS: The Age of Wavelets, The origin of Wavelets, Wavelets and other reality transforms, History of wavelets, Wavelets of the future.</p> <p>Continuous Wavelet and Short Time Fourier Transform: Wavelet Transform, Mathematical preliminaries, Properties of wavelets.</p> <p>Discrete Wavelet Transform: Haar scaling functions, Haar wavelet function, Daubechies Wavelets. (Chapters 1, 3 & 4 of Text 2)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Design adaptive filters for a given application ● Design multirate DSP Systems ● Implement adaptive signal processing algorithm ● Design active networks ● Understand important advanced signal processing techniques, including multi-rate processing and time-frequency analysis techniques 	
<p>Question paper pattern: The question paper will have ten questions.</p> <ul style="list-style-type: none"> ● Each full question consists of 16marks. ● There will be 2 full questions (with a maximum of four sub questions) from each module. ● Each full question will have sub questions covering all the topics under a module. ● The Students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. –Digital Signal Processing, Principles, Algorithms and Applications , John G.Proakis, Dimitris G.Manolakis, Fourth edition, Pearson-2007. 2. Insight into Wavelets- from Theory to Practicell , K.P Soman, Ramachandran, Resmi- PHI Third Edition-2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. "Modern Digital signal processing", Robert. O. Cristi, Cengage Publishers, India, 2003. 2. "Digital signal processing: A Practitioner's approach", E.C. Ifeachor, and B. W. Jarvis, , Second Edition, Pearson Education, India, 2002, Reprint. 3. –Wavelet Transforms, Introduction to Theory and applications , Raghuveer. M. Rao, Ajit S.Bopardikar, Pearson Education, Asia, 2000. 	

Error Control Coding			
[As per Choice Based Credit System (CBCS) Scheme]			
SEMESTER – II			
Subject Code	16ECS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> Explain the Entropy, information rate and capacity for the Discrete memoryless channel. Apply modern algebra and probability theory for the coding. Compare Block codes such as Linear Block Codes, Cyclic codes etc and Convolutional codes. Detect and correct errors for different data communication and storage systems. Implement different Block code encoders and decoders. Analyse and implement convolutional encoders and decoders. Analyse and apply soft and hard Viterbi algorithm for decoding of convolutional codes. 			
Modules			RBT Level
Module 1			
<p>Information theory: Introduction, Entropy, Source coding theorem, discrete memoryless channel, Mutual Information, Channel Capacity Channel coding theorem.(Chap. 5 of Text 1)</p> <p>Introduction to algebra: Groups, Fields, binary field arithmetic, Construction of Galois Fields $GF(2^m)$ and its properties, (Only statements of theorems without proof) Computation using Galois field $GF(2^m)$ arithmetic, Vector spaces and Matrices. (Chap. 2 of Text 2)</p>			L1,L2,L3
Module 2			
<p>Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, Single Parity Check Codes(SPC),Repetition codes, Self dual codes, Hamming codes, Reed-Muller codes. Product codes and Interleaved codes. (Chap. 3 of Text 2)</p>			L1,L2,L3
Module 3			
<p>Cyclic codes: Introduction, Generator and parity check polynomials, Encoding of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes, Error trapping Decoding, Cyclic hamming codes, Shortened cyclic codes.(Chap. 4 of Text2)</p>			L1,L2,L3
Module 4			
<p>BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field arithmetic, Implementation of error correction. (Chap. 6 of Text 2)</p> <p>Reed -Solomon codes. (Chap. 7 of Text 2)</p>			

<p>Majority Logic decodable codes: One -step majority logic decoding, One-step majority logic decodable codes, Two-step majority logic, decoding, Multiple-step majority logic. (Chap. 8 of Text 2)</p>	L1,L2,L3
<p>Module 5</p>	
<p>Convolution codes: Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes: Distance property of convolutional codes, Systematic and Nonsystematic Convolutional Codes, Performance Bounds for Convolutional Codes, Coding Gain. Other Convolutional Decoding Algorithms: Sequential Decoding, Feedback Decoding.(Chap. 7 of Text 3)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Analyse a discrete memoryless channel, given the source and transition probabilities. ● Apply the concept of modern linear algebra for the error control coding technique. ● Implement efficient LBC, Cyclic codes etc encoder and decoders. ● Apply decoding algorithms for efficient decoding of Block codes and Convolutional codes. 	
<p>Question paper pattern: The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.</p> <ul style="list-style-type: none"> ● There will be 2 full questions from each module covering all the topics of the module ● The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Simon Haykin, Digital Communication systems , First edition, Wiley India Private. Ltd, 2014. ISBN 978-81-265-4231-4 2. Shu Lin and Daniel J. Costello. Jr, "Error control coding", Pearson, Prentice Hall, 2nd edition, 2004. 3. Bernard Sklar, Digital Communications - Fundamentals and Applications , 2nd Edition Pearson Education (Asia) Ptv. Ltd, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Blahut. R. E, "Theory and practice of error control codes", Addison Wesley, 1984. 2. Salvatore Gravano, –Introduction to Error control coding , Oxford university press, 2007. 	

Advances in VLSI Design			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable the students to:</p> <ul style="list-style-type: none"> • Learn circuit-oriented approach towards digital design • Illustrate the impact of interconnect wiring on the functionality and performance of a digital gate. Infer different approaches to digital timing and clocking circuits Understand the impact of clock skew on the behaviour of digital synchronous circuits • Explain the role of peripheral circuitry such as the decoders, sense amplifiers, drivers and control circuitry in the design of reliable and fast memories 			
Modules			RBT Level
Module 1			
<p>Implementation Strategies For Digital ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective-The Implementation Platform of the Future.</p>			L1,L2,L3
Module 2			
<p>Coping With Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability-Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability-Ohmic Voltage Drop, Electromigration, Resistance and Performance-RC Delay, Inductive Parasitics, Inductance and Reliability-Voltage Drop, Inductance and Performance-Transmission Line Effects, Advanced Interconnect Techniques, Reduced-Swing Circuits, Current-Mode Transmission Techniques, Perspective: Networks-on-a-Chip.</p>			L1,L2,L3
Module 3			
<p>Timing Issues In Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Based Clocking, Self-Timed Circuit Design, Self-Timed Logic - An Asynchronous Technique, Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters,</p>			L1,L2,L3

Synchronizers-Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL.	
Module 4	
Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control.	L1,L2,L3
Module 5	
Designing Memory and Array Structures: Memory Reliability and Yield, Signal-to-Noise Ratio, Memory yield, Power Dissipation in Memories, Sources of Power Dissipation in Memories, Partitioning of the memory, Addressing the Active Power Dissipation, Data-retention dissipation, Case Studies in Memory Design: The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory, Perspective: Semiconductor Memory Trends and Evolutions.	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Apply design automation for complex circuits using the different implementation methodology like custom versus semi-custom, hardwired versus fixed, regular array versus ad-hoc. • Use the approaches to minimize the impact of interconnect parasitics on performance, power dissipation and circuit reliability • Impose the ordering of the switching events to meet the desired timing constraints using synchronous, clocked approach. • Infer the reliability of the memory. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Jan M Rabey, Anantha Chandrakasan, Borivoje Nikolic, –Digital Integrated Circuits-A Design Perspectivell , PHI, 2nd Edition.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. M. Smith, – Application Specific Integrated circuitsll , Addison Wesley, 1997 2. H. Veendrick, – MOS IC’s: From Basics to ASICs, Wiley-VCH, 1992. 3. Anantha P. Chandrakasan , Robert W. Brodersen, –Low Power Digital CMOS Designll , Kluwer Academic Publisher, 1995. 	

Real Time Operating System			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging Components, Exceptions, assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace			L1,L2,L3

Ports, External test equipment. (Text 1: Selected topics from Chap. 8,9)	
Module 5	
Process and Threads: Process and thread creations, Simple Programs, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication using multiple threads. (Text 2: Chap. 11)	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. • Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC to improve the system performance. • Apply priority based static and dynamic real time scheduling techniques for the given specifications. • Analyse deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. • Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, –Real-Time Embedded Systems and Componentsll , Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, DreamTech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, –Real Time Systemll , Pearson education, 2008. 2. DreamTech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008. 	

Multimedia over Communication Links			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16ECS252	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Gain fundamental knowledge in understanding the basics of different multimedia networks, applications, media types like text and image. • Analyse media types like audio and video and gain knowledge on multimedia systems. • Analyse Audio compression techniques required to compress Audio. • Analyse compression techniques required to compress video. • Gain fundamental knowledge about the Multimedia Communications in different Networks. 			
Modules			RBT Level
Module 1			
Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology. (Chap. 1 of Text1)			L1, L2, L3
Information Representation: Introduction, Text, Images. (Chap. 2- Sections 2.2 and 2.3 of Text 1)			
Module 2			
Information Representation: Audio and Video. (Chap. 2 - Sections 2.4 and 2.5 of Text 1)			L1, L2, L3
Distributed multimedia systems: Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems. (Chap. 4 - Sections 4.1 to 4.5 of Text 2)			
Module 3			
Multimedia Processing in Communication: Introduction, Perceptual coding of digital Audio signals, Transform Audio Coders, Audio Sub band Coders. (Chap. 3 - Sections 3.1, 3.2, 3.6, 3.7 of Text 2)			L1, L2, L3
Module 4			
Multimedia Communication Standards: Introduction, MPEG approach to multimedia standardization, MPEG-1, MPEG-2, Overview of MPEG-4. (Chap. 5 - Sections 5.1 to 5.4 and 5.5.1 of Text 2)			L1, L2, L3
Module 5			
Multimedia Communication Across Networks: Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks. (Chap. 6 - Sections 6.1, 6.2, 6.3 of Text 2)			L1, L2, L3

Course Outcomes: After studying this course, students will be able to:

- Understand basics of different multimedia networks, applications.
- Analyse media types like audio and video to represent in digital form.
- Understand different compression techniques to compress audio.
- Understand different compression techniques to compress audio video.
- Describe the basics of Multimedia Communication Across Networks

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Fred Halsall, –Multimedia Communicationsll , Pearson education, 2001, ISBN -9788131709948.
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, –Multimedia Communication Systemsll , Pearson education, 2004. ISBN - 9788120321458.

Reference Book:

Raif steinmetz, Klara Nahrstedt, –Multimedia: Computing, Communications and Applicationsll , Pearson education, 2002, ISBN -9788177584417.

Digital Electronics Lab -2

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Laboratory Code	16ELDL26	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to

1. Design and simulate digital electronic circuits using graphical programming tool LabVIEW.
2. Create user friendly interfaces using LabVIEW and analyze the input and output data for various digital circuits.
3. Use of assembly level programming for different applications using ARM-CORTEX M3 Kit and Keil uVision-4 tool.
4. Practice the different concepts and applications of C programming environment with ARM CORTEX M3.

Laboratory Experiments**Revised
Bloom's
Taxonomy
(RBT) Level****PART-A: Graphical Programming using LabVIEW**

- a) Design of 4 bit Adders (CLA, CSA, CMA, Parallel adders)
- b) Design of Binary Subtractors
- c) Design of Encoder (8X3), Decoder(3X8)
- d) Design of Multiplexer (8X1), and Demultiplexer (1X8)
- e) Design of code converters & Comparator
- f) Design of FF (SR, D, T, JK, and Master Slave with delays)
- g) Design of registers using latches and flip-flops
- h) Design of 8 bit Shift registers
- i) Design of Asynchronous & Synchronous Counters

L3

<p>PART-B: ARM-CORTEX M3 [Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U]</p> <ol style="list-style-type: none"> Write an Assembly language program to calculate 10+9+8+..... +1 Write a Assembly language program to link Multiple object files and link them together. Write a Assembly language program to store data in RAM. Write a C program to Output the "Hello World" message using UART. Write a C program to Design a Stopwatch using interrupts. Write an Exception vector table in C Write an Assembly Language Program for locking a Mutex. Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values. 	<p>L3</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Design and simulate the digital circuits using graphical programming tool LabVIEW. Build user friendly interfaces to interact with the digital circuits and to observe the outputs. Develop assembly programs for different applications using ARM Cortex M3 and Keil uVision-4 tool. Develop C Programs for different applications using ARM-Cortex M3 and Keil uVision-4 tool. 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments are to be included for practical examination. For examination, one question each to be set from PART-A and PART-B. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. Change of experiment is allowed only once and Marks allotted to the procedure part will be made zero. 	

M.Tech – DE & E - FOURTH SEMESTER SYLLABUS

Synthesis and Optimization of Digital Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ELD41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the need for optimization and dimensions of optimization for digital circuits. • Understand basic optimization techniques used in circuits design • Understand advanced tools and techniques in digital systems design including Hardware Modeling and Compilation Techniques. • Explain details of Logic-Level synthesis and optimization techniques for combinational and sequential circuits. • Explain the concept of scheduling and resource binding for optimization. 			
Modules			RBT Level
Module 1			
<p>Introduction to Synthesis and optimization: Design of Microelectronics circuits, Computer aided Synthesis and Optimization.</p> <p>Hardware Modeling: HDLs for Synthesis, Abstract models, Compilation and Behavioral Optimization. (Text1: Topics from Chap. 1,3)</p>			L1, L2, L3
Module 2			
<p>Graph theory for CAD for VLSI: Graphs, Combinatorial Optimization, Graph Optimization problems and Algorithms, Boolean Algebra and Applications.</p> <p>Architectural Synthesis and Optimization: Fundamental Architectural Synthesis problems, Area and Performance Estimation, Strategies for Architectural Optimization, Datapath Synthesis, Control Path Synthesis.(Text1: Topics From Chap. 2,4)</p>			L1, L2, L3
Module 3			
<p>Two level Combinational Logic Optimization: Introduction, Logic Optimizations, Operations on Two level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems.</p> <p>Multiple Level Combinational Logic Optimization: Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model. (Text1: Chap. 7, 8)</p>			L1, L2, L3
Module 4			
<p>Sequential Logic Optimization: Introduction, Sequential Logic Optimization using State based Models, Sequential Logic Optimization using Network Models,</p>			L1, L2, L3

Implicit FSM Traversal Methods, Testability concerns for Synchronous Circuits. (Text 1: Chap. 9)	
Module 5	
<p>Scheduling Algorithms: Introduction, A Model for Scheduling problems, Scheduling with Resource Constraints, Scheduling without Resource Constraints, Scheduling Algorithms for Extended Sequencing Models, Scheduling Pipelined Circuits.</p> <p>Resource Sharing and Binding: Sharing and Binding for Resource dominated circuits, Sharing and Binding for General Circuits, Concurrent Binding and Scheduling, Resource sharing and Binding for Non – Scheduled Sequencing Graphs. (Text1: Chap. 5,6)</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the process of synthesis and optimization in a top down approach for digital circuits models using HDLs. • Understand the terminologies of graph theory and its algorithms to optimize a Boolean equation. • Apply different two level and multilevel optimization algorithms for combinational circuits • Apply the different sequential circuit optimization methods using state models and network models. • Apply different scheduling algorithms with resource binding and without resource binding for pipelined sequential circuits and extended sequencing models. 	
<p>Question paper pattern:</p> <p>The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.</p> <ul style="list-style-type: none"> • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Giovanni De Micheli, –Synthesis and Optimization of Digital Circuits , Tata McGraw-Hill, 2003.</p>	
<p>Reference Book: Edwards M.D., Automatic Logic synthesis Techniques for Digital Systems, Macmillan New Electronic Series, 1992.</p>	

Advances in Image Processing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ECS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> Acquire fundamental knowledge in understanding the representation of the digital image and its properties Equip with some pre-processing techniques required to enhance the image for further analysis purpose. Select the region of interest in the image using segmentation techniques. Represent the image based on its shape and edge information. Describe the objects present in the image based on its properties and structure. 			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and watersheds.			L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> Understand the representation of the digital image and its properties 			

Apply pre-processing techniques required to enhance the image for its further analysis.

- Use segmentation techniques to select the region of interest in the image for analysis
Represent the image based on its shape and edge information.
Describe the objects present in the image based on its properties and structure.
- Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects.

Question paper pattern:

The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.

- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Milan Sonka, Vaclav Hlavac, Roger Boyle, –Image Processing, Analysis, and Machine Vision, Cengage Learning, 2013, ISBN: 978-81-315-1883-0

Reference Books:

1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010
2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011

**SCHEME OF TEACHING AND EXAMINATION
M.Tech in DIGITAL ELECTRONICS / ELECTRONICS**

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16ELD11	Advanced Engineering Mathematics	4	-	3	20	80	100	4
2	16EVE12	Digital VLSI Design	4	-	3	20	80	100	4
3	16EVE13	Advanced Embedded System	4	-	3	20	80	100	4
4	16ELD14	Digital Circuit and Logic Design	4	-	3	20	80	100	4
5	16EXX15X	Elective-1	3	-	3	20	80	100	3
6	16ELDL16	Digital Electronics Lab -1		3	3	20	80	100	2
7	16ELD17	Seminar on advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective-1	
16EVE151	Digital System Design using Verilog

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

II SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16ECS21	Advanced DSP	4	-	3	20	80	100	4
2	16ECS22	Error Control Coding	4	-	3	20	80	100	4
3	16EVE23	Advances in VLSI Design	4	-	3	20	80	100	4
4	16EVE24	Real Time Operating System	4	-	3	20	80	100	4
5	16EXX25X	Elective –2	3	-	3	20	80	100	3
6	16ELDL26	Digital Electronics Lab - 2		3	3	20	80	100	2
7	16ELD27	Seminar on Advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective-2	
16ECS252	Multimedia Over Communication Links

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

III SEMESTER: Internship

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16ELD31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16ELD32	Report on Internship	-	-	-	25	-	50	
3	16ELD33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16ELD34	Evaluation of Project phase -1	-	-	-	50	-	25	1
TOTAL			-	-	-	100	50	150	21

M.Tech in DIGITAL ELECTRONICS / ELECTRONICS

(Common to M.Tech in Digital Electronics and M.Tech in Electronics)

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/ Assignment	Duration	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16ELD41	Synthesis and optimization of Digital Circuits	4	-	3	20	80	100	4
2	16EXX42X	Elective-3	3	-	3	20	80	100	3
3	16ELD43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16ELD44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			-	-	6	90	360	450	20

Elective-3	
16ECS422	Advances in Image Processing

Note:

- 1. Project Phase-1:** 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.
- 2. Project Phase-2:** 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
- 3. Project Evaluation:** Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted .
 - a. Internal Examiner shall carry out the evaluation for 100 marks.
 - b. External Examiner shall carry out the evaluation for 100 marks.
 - c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
 - d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.Tech – DE & E - FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject Code	16ELD11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Acquaint with principles of linear algebra, calculus of variations, probability theory and random process. • Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>Linear Algebra-I Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank-Nullity theorem(without proof). Matrix form of linear transformations-Illustrative examples.(Text 1 & Ref. 1)</p>			L1,L2
Module -2			
<p>Linear Algebra-II Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations.(Text 1 & Ref. 1)</p>			L1,L2
Module -3			
<p>Calculus of Variations Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.(Text 2 & Ref. 2)</p>			L1,L2
Module -4			

<p>Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions-examples.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Module -5</p>	
<p>Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Statement of central limit theorem-Illustrative examples. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images. • Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems. • Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits. • Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications. • Apply the idea of joint probability distributions and the role of parameter-dependent random variables in random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, —Advanced Engineering Mathematics|| , 10th edition, Wiley, 2015.
3. Scott L.Miller, Donald G. Childers: —Probability and Random Process with application to Signal Processing|| , Elsevier Academic Press, 2nd Edition,2013.

Reference books:

1. Richard Bronson: —Schaum’s Outlines of Theory and Problems of Matrix Operations|| , McGraw-Hill, 1988.
2. Elsgolts, L.:|| Differential Equations and Calculus of Variations|| , MIR Publications, 3rd Edition, 1977.
3. T.Veerarajan: —Probability, Statistics and Random Process—,3rd Edition, Tata McGraw Hill Co.,2008.

Web links:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>
4. www.wolfram.com

DIGITAL VLSI DESIGN [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	16EVE12	IA Marks	20
Number	04	Exam Marks	80
Total Number of	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Explain VLSI Design Methodologies • Learn Static and Dynamic operation principles, analysis and design of inverter circuit. • Infer state of the art Semiconductors Memory circuits. • Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits. • Illustrate VLSI and ASIC design. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.</p> <p>MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.</p>			L1, L2
Module -2			
<p>MOS Inverters-Static Characteristics: CMOS Inverter.</p> <p>MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.</p>			L2, L3
Module -3			

<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>	<p>L1, L2, L3</p>
<p>Module -4</p>	
<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Sung Mo Kang & Yosuf Leblebici, –CMOS Digital Integrated Circuits: Analysis and Designll , Tata McGraw-Hill, Third Edition.</p>	

Reference Books:

1. Neil Weste and K. Eshragian, —Principles of CMOS VLSI Design: A System Perspective, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.
2. Wayne, Wolf, —Modern VLSI Design: System on Silicon, Prentice Hall PTR/Pearson Education, Second Edition, 1998.
3. Douglas A Pucknell & Kamran Eshragian , —Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).

ADVANCED EMBEDDED SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EVE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

Describe the hardware software co-design and firmware design approaches

Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.

Program ARM CORTEX M3 using the various instructions, for different applications.

Modules	Revised Bloom's Taxonomy (RBT) Level
Module -1	
Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).	L1, L2, L3
Module -2	
Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).	L1, L2, L3
Module -3	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)	L1, L2, L3

Module -4	
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6)	L1, L2, L3
Module -5	
Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. Explain the hardware software co-design and firmware design approaches. Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. • Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, –The Definitive Guide to the ARM Cortex-M3, 2ndedn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

DIGITAL CIRCUITS AND LOGIC DESIGN			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject Code	16ELD14	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand the concepts of sequential machines ● Design Sequential Machines/Circuits ● Analyze the faults in the design of circuits ● Apply fault detection experiments to sequential circuits 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks, Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities.			L1, L2,L3
Module -2			
Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic, Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits.			L1, L2, L3,L4
Module -3			
Fault-Location Experiments, Boolean Differences, Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.			L1, L2, L3,L4
Module -4			
Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, ELD ecompositions, Synthesis of Multiple Machines.			L1, L2, L3,L4
Module -5			

<p>State Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection.</p>	<p>L1, L2, L3,L4</p>
<p>Course outcomes: At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> ● Understand the concepts of sequential machines ● Design Sequential Machines/Circuits ● Analyze the faults in the design of circuits ● Apply fault detection experiments to sequential circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Zvi Kohavi, –Switching and Finite Automata Theoryll , 2nd Edition, TMH.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Charles Roth Jr., –Digital Circuits and logic Designll , 7thedn, Cengage Learning, 2014. 2. Parag K Lala, –Fault Tolerant And Fault Testable Hardware Designll , Prentice Hall Inc. 1985. 3. E. V. Krishnamurthy, –Introductory Theory of Computerll , Macmillan Press Ltd, 1983 4. Mishra & Chandrasekaran, –Theory of computer science – Automata, Languages and Computationll , 2nd Edition, PHI, 2004. 	

DIGITAL SYSTEM DESIGN USING VERILOG [As per Choice Based Credit System (CBCS) scheme]			
Subject Code	16EVE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand the concepts of Verilog Language ● Design the digital systems as an activity in a larger systems design context. ● Study the design and operation of semiconductor memories frequently used in application specific digital system. ● Inspect how effectively IC's are embedded in package and assembled in PCB's for different application ● Design and diagnosis of processors and I/O controllers they can be used in embedded systems 			
Modules			Revised Bloom's Taxonomy (RBT)
Module -1			
Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.			L1, L2
Module -2			
Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers. Sequential Basics: Storage elements, Counters, Sequential Data paths and Control, Clocked Synchronous Timing Methodology.			L1, L2
Module -3			
Memories: Concepts, Memory Types, Error Detection and Correction. Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.			L1, L2
Module -4			
Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory. I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.			L2, L3
Module -5			

<p>Accelerators: Concepts, case study, Verification of accelerators. Design Methodology: Design flow, Design optimization, Design for test.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Design embedded systems, using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores. • Design construct the combinational circuits using discrete gates and programmable logic devices. • Describe Verilog model for sequential circuits and test pattern generation • Explore the different types of semiconductor memories and their usage for specific chip design • Synthesis different types of processor and I/O controllers that are used in embedded system design 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Peter J. Ashenden, –Digital Design: An Embedded Systems Approach Using VERILOG^{II}, Elsevier, 2010.</p>	
<p>Reference Book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Samir Palnitkar.</p>	

DIGITAL ELECTRONICS LAB -1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory Code	16ELDL16	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to get practical experience on the

- Design tool such as Cadence OrCAD/ OrCAD Lite /EDA tool
- Design of analog and digital circuits using the simulation tool
- FPGA Design and testing for digital circuits
- Verilog programming and design of digital circuits
- Design, verification and performance testing

Laboratory Experiments**Revised Bloom's Taxonomy (RBT) Level****1. Using Cadence OrCAD or OrCAD Lite or any EDA Tool, design and verify the following:****L2,L3,L4**

- a) 3½ Digit Digital Voltmeter
- b) Monolithic function Generator
- c) Regulated Power supplies
- d) Batch counter using TTL ICs.
- e) DAC and ADC
- f) P, PI, PID and ON/OFF Controllers
- g) Programmable Timers
- h) Filters and Resonance Circuits

<p>2. Develop Verilog Program for design and testing the following digital circuits (for 4/8 bits) using FPGA/CPLD. Use logic analyzer/Chipscope for the verification of results.</p> <p>(Note: Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro. Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits.)</p> <ol style="list-style-type: none"> Carry skip and carry look ahead adder BCD adder and subtractor Array Multiplication (signed and unsigned) Booth multiplication (radix-4) Magnitude comparator LFSR Parity generator Universal Shift Register Sequence generation (11101 say) using Mealy/Moore FSM 	<p>L2, L3, L4</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Design an analog and digital systems using Cadence OrCAD, OrCAD Lite or any EDA tool. Develop Verilog Programs for Digital Circuit design simulation. Design and implement digital systems on FPGA/CPLD Testing and validation of digital systems using Logic analyzer/Chipscope 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments are to be included for practical examination. For examination, two questions using different tool to be set. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero. 	

M.Tech – DE & E - SECOND SEMESTER SYLLABUS

Advanced DSP			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16ECS21	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand Multirate digital signal processing principles and its applications. ● Estimate the various spectral components present in the received signal using different spectral estimation methods such as Parametric and Nonparametric. ● Design and implement an optimum adaptive filter using LMS and RLS algorithms. ● Understand the concepts and mathematical representations of Wavelet transforms. 			
Modules			RBT Level
Module 1			
<p>Multirate Digital Signal Processing: Introduction, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks, M-channel QMF bank. (Text 1)</p>			L1,L2,L3
Module 2			
<p>Linear prediction and Optimum Linear Filters: Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters. (Text 1)</p>			L1,L2,L3
Module 3			
<p>Adaptive filters: Applications of adaptive filters- Adaptive channel equalization,, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm. (Text 1)</p>			L1,L2,L3
Module 4			
<p>Power Spectrum Estimation: Non parametric Methods for Power Spectrum Estimation - Bartlett Method, Welch Method, Blackman and Tukey Methods. Parametric Methods for Power Spectrum Estimation: Relationship between the auto correlation and the model</p>			

parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, Unconstrained least-squares method for the AR Model parameters, Sequential estimation methods for the AR Model parameters, ARMA Model for Power Spectrum Estimation. (Text 1)	L1,L2,L3
Module 5	
<p>WAVELET TRANSFORMS: The Age of Wavelets, The origin of Wavelets, Wavelets and other reality transforms, History of wavelets, Wavelets of the future.</p> <p>Continuous Wavelet and Short Time Fourier Transform: Wavelet Transform, Mathematical preliminaries, Properties of wavelets.</p> <p>Discrete Wavelet Transform: Haar scaling functions, Haar wavelet function, Daubechies Wavelets. (Chapters 1, 3 & 4 of Text 2)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Design adaptive filters for a given application ● Design multirate DSP Systems ● Implement adaptive signal processing algorithm ● Design active networks ● Understand important advanced signal processing techniques, including multi-rate processing and time-frequency analysis techniques 	
<p>Question paper pattern: The question paper will have ten questions.</p> <ul style="list-style-type: none"> ● Each full question consists of 16marks. ● There will be 2 full questions (with a maximum of four sub questions) from each module. ● Each full question will have sub questions covering all the topics under a module. ● The Students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. –Digital Signal Processing, Principles, Algorithms and Applications , John G.Proakis, Dimitris G.Manolakis, Fourth edition, Pearson-2007. 2. Insight into Wavelets- from Theory to Practicell , K.P Soman, Ramachandran, Resmi- PHI Third Edition-2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. "Modern Digital signal processing", Robert. O. Cristi, Cengage Publishers, India, 2003. 2. "Digital signal processing: A Practitioner's approach", E.C. Ifeachor, and B. W. Jarvis, , Second Edition, Pearson Education, India, 2002, Reprint. 3. –Wavelet Transforms, Introduction to Theory and applications , Raghuveer. M. Rao, Ajit S.Bopardikar, Pearson Education, Asia, 2000. 	

Error Control Coding			
[As per Choice Based Credit System (CBCS) Scheme]			
SEMESTER – II			
Subject Code	16ECS22	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain the Entropy, information rate and capacity for the Discrete memoryless channel. Apply modern algebra and probability theory for the coding. Compare Block codes such as Linear Block Codes, Cyclic codes etc and Convolutional codes. • Detect and correct errors for different data communication and storage systems. Implement different Block code encoders and decoders. Analyse and implement convolutional encoders and decoders. Analyse and apply soft and hard Viterbi algorithm for decoding of convolutional codes. 			
Modules			RBT Level
Module 1			
<p>Information theory: Introduction, Entropy, Source coding theorem, discrete memoryless channel, Mutual Information, Channel Capacity Channel coding theorem.(Chap. 5 of Text 1)</p> <p>Introduction to algebra: Groups, Fields, binary field arithmetic, Construction of Galois Fields $GF(2^m)$ and its properties, (Only statements of theorems without proof) Computation using Galois field $GF(2^m)$ arithmetic, Vector spaces and Matrices. (Chap. 2 of Text 2)</p>			L1,L2,L3
Module 2			
<p>Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, Single Parity Check Codes(SPC),Repetition codes, Self dual codes, Hamming codes, Reed-Muller codes. Product codes and Interleaved codes. (Chap. 3 of Text 2)</p>			L1,L2,L3
Module 3			
<p>Cyclic codes: Introduction, Generator and parity check polynomials, Encoding of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes, Error trapping Decoding, Cyclic hamming codes, Shortened cyclic codes.(Chap. 4 of Text2)</p>			L1,L2,L3
Module 4			
<p>BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field arithmetic, Implementation of error correction. (Chap. 6 of Text 2)</p> <p>Reed -Solomon codes. (Chap. 7 of Text 2)</p>			

<p>Majority Logic decodable codes: One -step majority logic decoding, One-step majority logic decodable codes, Two-step majority logic, decoding, Multiple-step majority logic. (Chap. 8 of Text 2)</p>	L1,L2,L3
<p>Module 5</p>	
<p>Convolution codes: Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes: Distance property of convolutional codes, Systematic and Nonsystematic Convolutional Codes, Performance Bounds for Convolutional Codes, Coding Gain. Other Convolutional Decoding Algorithms: Sequential Decoding, Feedback Decoding.(Chap. 7 of Text 3)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Analyse a discrete memoryless channel, given the source and transition probabilities. ● Apply the concept of modern linear algebra for the error control coding technique. ● Implement efficient LBC, Cyclic codes etc encoder and decoders. ● Apply decoding algorithms for efficient decoding of Block codes and Convolutional codes. 	
<p>Question paper pattern: The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.</p> <ul style="list-style-type: none"> ● There will be 2 full questions from each module covering all the topics of the module ● The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Simon Haykin, Digital Communication systems , First edition, Wiley India Private. Ltd, 2014. ISBN 978-81-265-4231-4 2. Shu Lin and Daniel J. Costello. Jr, "Error control coding", Pearson, Prentice Hall, 2nd edition, 2004. 3. Bernard Sklar, Digital Communications - Fundamentals and Applications , 2nd Edition Pearson Education (Asia) Ptv. Ltd, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Blahut. R. E, "Theory and practice of error control codes", Addison Wesley, 1984. 2. Salvatore Gravano, –Introduction to Error control coding , Oxford university press, 2007. 	

Advances in VLSI Design			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Learn circuit-oriented approach towards digital design • Illustrate the impact of interconnect wiring on the functionality and performance of a digital gate. Infer different approaches to digital timing and clocking circuits Understand the impact of clock skew on the behaviour of digital synchronous circuits • Explain the role of peripheral circuitry such as the decoders, sense amplifiers, drivers and control circuitry in the design of reliable and fast memories 			
Modules			RBT Level
Module 1			
Implementation Strategies For Digital ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective-The Implementation Platform of the Future.			L1,L2,L3
Module 2			
Coping With Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability-Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability-Ohmic Voltage Drop, Electromigration, Resistance and Performance-RC Delay, Inductive Parasitics, Inductance and Reliability-Voltage Drop, Inductance and Performance-Transmission Line Effects, Advanced Interconnect Techniques, Reduced-Swing Circuits, Current-Mode Transmission Techniques, Perspective: Networks-on-a-Chip.			L1,L2,L3
Module 3			
Timing Issues In Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Based Clocking, Self-Timed Circuit Design, Self-Timed Logic - An Asynchronous Technique, Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters,			L1,L2,L3

Synchronizers-Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL.	
Module 4	
Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control.	L1,L2,L3
Module 5	
Designing Memory and Array Structures: Memory Reliability and Yield, Signal-to-Noise Ratio, Memory yield, Power Dissipation in Memories, Sources of Power Dissipation in Memories, Partitioning of the memory, Addressing the Active Power Dissipation, Data-retention dissipation, Case Studies in Memory Design: The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory, Perspective: Semiconductor Memory Trends and Evolutions.	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Apply design automation for complex circuits using the different implementation methodology like custom versus semi-custom, hardwired versus fixed, regular array versus ad-hoc. • Use the approaches to minimize the impact of interconnect parasitics on performance, power dissipation and circuit reliability • Impose the ordering of the switching events to meet the desired timing constraints using synchronous, clocked approach. • Infer the reliability of the memory. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Jan M Rabey, Anantha Chandrakasan, Borivoje Nikolic, –Digital Integrated Circuits-A Design Perspectivell , PHI, 2nd Edition.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. M. Smith, – Application Specific Integrated circuitsll , Addison Wesley, 1997 2. H. Veendrick, – MOS IC’s: From Basics to ASICs, Wiley-VCH, 1992. 3. Anantha P. Chandrakasan , Robert W. Brodersen, –Low Power Digital CMOS Designll , Kluwer Academic Publisher, 1995. 	

Real Time Operating System [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging Components, Exceptions, assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace			L1,L2,L3

Ports, External test equipment. (Text 1: Selected topics from Chap. 8,9)	
Module 5	
Process and Threads: Process and thread creations, Simple Programs, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication using multiple threads. (Text 2: Chap. 11)	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. • Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC to improve the system performance. • Apply priority based static and dynamic real time scheduling techniques for the given specifications. • Analyse deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. • Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, –Real-Time Embedded Systems and Componentsll , Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, DreamTech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, –Real Time Systemll , Pearson education, 2008. 2. DreamTech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008. 	

Multimedia over Communication Links

[As per Choice Based credit System (CBCS) Scheme
SEMESTER – II

Subject Code	16ECS252	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

CREDITS – 03

Course Objectives: This course will enable students to:

- Gain fundamental knowledge in understanding the basics of different multimedia networks, applications, media types like text and image.
- Analyse media types like audio and video and gain knowledge on multimedia systems.
- Analyse Audio compression techniques required to compress Audio.
- Analyse compression techniques required to compress video.
- Gain fundamental knowledge about the Multimedia Communications in different Networks.

Modules	RBT Level
Module 1	
Multimedia Communications: Introduction, Multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology. (Chap. 1 of Text1) Information Representation: Introduction, Text, Images. (Chap. 2- Sections 2.2 and 2.3 of Text 1)	L1, L2, L3
Module 2	
Information Representation: Audio and Video. (Chap. 2 - Sections 2.4 and 2.5 of Text 1) Distributed multimedia systems: Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems. (Chap. 4 - Sections 4.1 to 4.5 of Text 2)	L1, L2, L3
Module 3	
Multimedia Processing in Communication: Introduction, Perceptual coding of digital Audio signals, Transform Audio Coders, Audio Sub band Coders. (Chap. 3 - Sections 3.1, 3.2, 3.6, 3.7 of Text 2)	L1, L2, L3
Module 4	
Multimedia Communication Standards: Introduction, MPEG approach to multimedia standardization, MPEG-1, MPEG-2, Overview of MPEG-4. (Chap. 5 - Sections 5.1 to 5.4 and 5.5.1 of Text 2)	L1, L2, L3
Module 5	
Multimedia Communication Across Networks: Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks. (Chap. 6 - Sections 6.1, 6.2, 6.3 of Text 2)	L1, L2, L3

Course Outcomes: After studying this course, students will be able to:

- Understand basics of different multimedia networks, applications.
- Analyse media types like audio and video to represent in digital form.
- Understand different compression techniques to compress audio.
- Understand different compression techniques to compress audio video.
- Describe the basics of Multimedia Communication Across Networks

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Fred Halsall, –Multimedia Communicationsll , Pearson education, 2001, ISBN -9788131709948.
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, –Multimedia Communication Systemsll , Pearson education, 2004. ISBN - 9788120321458.

Reference Book:

Raif steinmetz, Klara Nahrstedt, –Multimedia: Computing, Communications and Applicationsll , Pearson education, 2002, ISBN -9788177584417.

Digital Electronics Lab -2

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Laboratory Code	16ELDL26	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This laboratory course enables students to

1. Design and simulate digital electronic circuits using graphical programming tool LabVIEW.
2. Create user friendly interfaces using LabVIEW and analyze the input and output data for various digital circuits.
3. Use of assembly level programming for different applications using ARM-CORTEX M3 Kit and Keil uVision-4 tool.
4. Practice the different concepts and applications of C programming environment with ARM CORTEX M3.

Laboratory Experiments

**Revised
Bloom's
Taxonomy
(RBT) Level**

PART-A: Graphical Programming using LabVIEW

- a) Design of 4 bit Adders (CLA, CSA, CMA, Parallel adders)
- b) Design of Binary Subtractors
- c) Design of Encoder (8X3), Decoder(3X8)
- d) Design of Multiplexer (8X1), and Demultiplexer (1X8)
- e) Design of code converters & Comparator
- f) Design of FF (SR, D, T, JK, and Master Slave with delays)
- g) Design of registers using latches and flip-flops
- h) Design of 8 bit Shift registers
- i) Design of Asynchronous & Synchronous Counters

L3

<p>PART-B: ARM-CORTEX M3 [Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U]</p> <ol style="list-style-type: none"> a) Write an Assembly language program to calculate 10+9+8+..... +1 b) Write a Assembly language program to link Multiple object files and link them together. c) Write a Assembly language program to store data in RAM. d) Write a C program to Output the "Hello World" message using UART. e) Write a C program to Design a Stopwatch using interrupts. f) Write an Exception vector table in C g) Write an Assembly Language Program for locking a Mutex. h) Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values. 	<p>L3</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Design and simulate the digital circuits using graphical programming tool LabVIEW. • Build user friendly interfaces to interact with the digital circuits and to observe the outputs. • Develop assembly programs for different applications using ARM Cortex M3 and Keil uVision-4 tool. • Develop C Programs for different applications using ARM-Cortex M3 and Keil uVision-4 tool. 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. For examination, one question each to be set from PART-A and PART-B. 3. Students are allowed to pick one experiment from the lot. 4. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. 5. Change of experiment is allowed only once and Marks allotted to the procedure part will be made zero. 	

M.Tech – DE & E - FOURTH SEMESTER SYLLABUS

Synthesis and Optimization of Digital Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ELD41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the need for optimization and dimensions of optimization for digital circuits. • Understand basic optimization techniques used in circuits design • Understand advanced tools and techniques in digital systems design including Hardware Modeling and Compilation Techniques. • Explain details of Logic-Level synthesis and optimization techniques for combinational and sequential circuits. • Explain the concept of scheduling and resource binding for optimization. 			
Modules			RBT Level
Module 1			
<p>Introduction to Synthesis and optimization: Design of Microelectronics circuits, Computer aided Synthesis and Optimization.</p> <p>Hardware Modeling: HDLs for Synthesis, Abstract models, Compilation and Behavioral Optimization. (Text1: Topics from Chap. 1,3)</p>			L1, L2, L3
Module 2			
<p>Graph theory for CAD for VLSI: Graphs, Combinatorial Optimization, Graph Optimization problems and Algorithms, Boolean Algebra and Applications.</p> <p>Architectural Synthesis and Optimization: Fundamental Architectural Synthesis problems, Area and Performance Estimation, Strategies for Architectural Optimization, Datapath Synthesis, Control Path Synthesis.(Text1: Topics From Chap. 2,4)</p>			L1, L2, L3
Module 3			
<p>Two level Combinational Logic Optimization: Introduction, Logic Optimizations, Operations on Two level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems.</p> <p>Multiple Level Combinational Logic Optimization: Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model. (Text1: Chap. 7, 8)</p>			L1, L2, L3
Module 4			
<p>Sequential Logic Optimization: Introduction, Sequential Logic Optimization using State based Models, Sequential Logic Optimization using Network Models,</p>			L1, L2, L3

Implicit FSM Traversal Methods, Testability concerns for Synchronous Circuits. (Text 1: Chap. 9)	
Module 5	
<p>Scheduling Algorithms: Introduction, A Model for Scheduling problems, Scheduling with Resource Constraints, Scheduling without Resource Constraints, Scheduling Algorithms for Extended Sequencing Models, Scheduling Pipelined Circuits.</p> <p>Resource Sharing and Binding: Sharing and Binding for Resource dominated circuits, Sharing and Binding for General Circuits, Concurrent Binding and Scheduling, Resource sharing and Binding for Non – Scheduled Sequencing Graphs. (Text1: Chap. 5,6)</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the process of synthesis and optimization in a top down approach for digital circuits models using HDLs. • Understand the terminologies of graph theory and its algorithms to optimize a Boolean equation. • Apply different two level and multilevel optimization algorithms for combinational circuits • Apply the different sequential circuit optimization methods using state models and network models. • Apply different scheduling algorithms with resource binding and without resource binding for pipelined sequential circuits and extended sequencing models. 	
<p>Question paper pattern:</p> <p>The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.</p> <ul style="list-style-type: none"> • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Giovanni De Micheli, –Synthesis and Optimization of Digital Circuits , Tata McGraw-Hill, 2003.</p>	
<p>Reference Book: Edwards M.D., Automatic Logic synthesis Techniques for Digital Systems, Macmillan New Electronic Series, 1992.</p>	

Advances in Image Processing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ECS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> Acquire fundamental knowledge in understanding the representation of the digital image and its properties Equip with some pre-processing techniques required to enhance the image for further analysis purpose. Select the region of interest in the image using segmentation techniques. Represent the image based on its shape and edge information. Describe the objects present in the image based on its properties and structure. 			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and watersheds.			L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> Understand the representation of the digital image and its properties 			

Apply pre-processing techniques required to enhance the image for its further analysis.

- Use segmentation techniques to select the region of interest in the image for analysis
Represent the image based on its shape and edge information.
Describe the objects present in the image based on its properties and structure.
- Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects.

Question paper pattern:

The question paper will have 10 full questions carrying equal marks. Each full question consists of 16 marks with a maximum of four sub questions.

- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Milan Sonka, Vaclav Hlavac, Roger Boyle, –Image Processing, Analysis, and Machine Vision, Cengage Learning, 2013, ISBN: 978-81-315-1883-0

Reference Books:

1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010
2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI										
Scheme of Teaching and Examination – 2018-19										
M.Tech in Digital Electronics / Electronics (ELD)										
Choice Based Credit System (CBCS)										
I SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18ELD11	Advanced Engineering Mathematics	04	--	03	40	60	100	4
2	PCC	18ECS12	Advanced Digital Signal Processing	04	--	03	40	60	100	4
3	PCC	18EVE13	Advanced Embedded System	04	--	03	40	60	100	4
4	PCC	18ELD14	Digital Circuit and Logic Design	04	--	03	40	60	100	4
5	PCC	18EVE15	Digital VLSI Design	04	--	03	40	60	100	4
6	PCC	18ELDL16	Embedded Systems Lab	-	04	03	40	60	100	2
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2
TOTAL				22	04	21	280	420	700	24
Note: PCC: Professional core.										
Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination will be conducted during III semester and prescribed credit shall be included in the III semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during subsequent University examination after satisfying the internship requirements.										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI										
Scheme of Teaching and Examination – 2018-19										
M.Tech in Digital Electronics / Electronics (ELD)										
Choice Based Credit System (CBCS)										
II SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18ELD21	Advanced Computer Architecture	04	--	03	40	60	100	4
2	PCC	18EVE22	Real Time Operating System	04	--	03	40	60	100	4
3	PCC	18ECS23	Error Control Coding	04	--	03	40	60	100	4
4	PEC	18XXX24X	Professional Elective 1	04	--	03	40	60	100	4
5	PEC	18XXX25X	Professional Elective 2	04	--	03	40	60	100	4
6	PCC	18ELDL26	Digital Circuits Simulation Lab	--	04	03	40	60	100	2
7	PCC	18ELD27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				20	06	18	340	360	700	24
Note: PCC: Professional core, PEC: Professional Elective.										
Professional Elective 1					Professional Elective 2					
Course Code under 18XXX24X		Course title			Course Code under 18XXX25X		Course title			
18ECS241		Wireless Sensor Networks			18EVE252		SoC Design			
Note:										
<p>1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide in any and a senior faculty of the department. Participation in seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.</p> <p>The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.</p> <p>2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination will be conducted during III semester and prescribed credit shall be included in the III semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during subsequent University examination after satisfying the internship requirements.</p>										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI										
Scheme of Teaching and Examination – 2018-19										
M.Tech in Digital Electronics / Electronics (ELD)										
Choice Based Credit System (CBCS)										
III SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	PCC	18ELD31	Synthesis and Optimization of Digital Circuits	04	--	03	40	60	100	4
2	PEC	18XXX32X	Professional Elective 3	04	--	03	40	60	100	4
3	PEC	18XXX33X	Professional Elective 4	04	--	03	40	60	100	4
4	Proj	18XXX34	Evaluation of Project phase -1	--	02	--	100	--	100	2
5	INT	18ELD35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	260	240	500	20
Note: PCC: Professional core, PEC: Professional Elective, Proj: Project, INT: Internship.										
Professional Elective 3					Professional Elective 4					
Course Code under 18XXX32X		Course title			Course Code under 18XXX33X		Course title			
18ECS321		Advances in Image Processing			18ECS333		Internet of Things			
Note:										
<p>1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.</p> <p>SEE (University examination) shall be as per the University norms.</p> <p>2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements.</p> <p>Internship SEE (University examination) shall be as per the University norms.</p>										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination – 2018-19 M.Tech in Digital Electronics / Electronics (ELD) Choice Based Credit System (CBCS)										
IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce		Total Marks
1	Proj	18ELD41	Project work phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20
Note: Proj: Project.										
Note:										
1. Project Phase-2:										
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.										
SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.										

M.Tech 2018-Digital Electronics/ Electronics –
FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject	18ELD11	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> To learn principles of advanced engineering mathematics through linear algebra and calculus of variations. To understand probability theory and random process that serve as an essential tool for applications of electronics and communication engineering sciences. 			
Modules			RBT Level
Module -1			
<p><u>Linear Algebra-I</u> Introduction to vector spaces and sub-spaces, definitions, illustrative example. Linearly independent and dependent vectors- Basis-definition and problems. Linear transformations-definitions. Matrix form of linear transformations-Illustrative examples (Text Book:1).</p>			L1, L2
Module -2			
<p><u>Linear Algebra-II</u> Computation of eigen values and eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process (Text. Book:1).</p>			L1, L2
Module -3			
<p>Calculus of Variations : - Concept of functional-Eulers equation. Functional dependent on first and higher order derivatives, Functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.</p>			L1, L2
Module -4			

<p>Probability Theory:-Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Poisson, Gaussian and Erlang distributions-examples. (Text Book: 3)</p>	<p>L1, L2</p>
<p>Module -5</p>	
<p>Engineering Applications on Random processes:- Classification. Stationary, WSS and ergodic random process. Auto-correlation function-properties, Gaussian random process. (Text Book: 3)</p>	<p>L2, L3, L4</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <p>CO-1: Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.</p> <p>CO-2: Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.</p> <p>CO-3: Utilize the concepts of functional and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.</p> <p>CO-4: Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.</p> <p>CO-5: Analyze random process through parameter-dependent variables in various random processes.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. David C.Lay, Steven R.Lay and J.J.McDonald: “LinearAlgebra and its Applications”, 5thEdition, Pearson Education Ltd., 2015 2. Elsgolts, L.:”Differential Equations and Calculus of Variations”, MIR Publications, 3rdEdition, 1977. 3. T.Veerarajan: “Probability, Statistics and Random Process“,3rd Edition,Tata Mc-Graw Hill Co.,2016. 	

Reference Books:

1. Gilbert Strang: Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press., 2016
2. Richard Bronson: "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
3. Scott L. Miller, Donald G. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition, 2013.

Web links:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>
4. www.wolfram.com

ADVANCED DIGITAL SIGNAL PROCESSING [As per Choice Based Credit System (CBCS) Scheme] SEMESTER – I			
Course Code	18ECS12	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand Multirate digital signal processing principles and its applications. • Estimate the various spectral components present in the received signal using different spectral estimation methods such as Parametric and Nonparametric. • Design and implement an optimum adaptive filter using LMS and RLS algorithms. • Understand the concepts and mathematical representations of Wavelet transforms. 			
Modules			RBT Levels
Module-1			
Multirate Digital Signal Processing: Introduction, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks, M-channel QMF bank. (Text 1)			L1, L2, L3
Module-2			
Linear prediction and Optimum Linear Filters: Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations. The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters. (Text 1)			L1, L2, L3
Module-3			
Adaptive filters: Applications of Adaptive Filters-Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm. (Text 1)			L1, L2, L3
Module-4			
Power Spectrum Estimation: Non parametric Methods for Power Spectrum Estimation - Bartlett Method, Welch Method, Blackman and Tukey Methods. Parametric Methods for Power Spectrum Estimation:			L1, L2, L3

Relationship between the auto correlation and the model parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, Unconstrained least-squares method for the AR Model parameters, Sequential estimation methods for the AR Model parameters, ARMA Model for Power Spectrum Estimation. (Text 1)	
Module-5	
<p>WAVELET TRANSFORMS: The Age of Wavelets, The origin of Wavelets, Wavelets and other reality transforms, History of wavelets, Wavelets of the future.</p> <p>Continuous Wavelet and Short Time Fourier Transform: Wavelet Transform, Mathematical preliminaries, Properties of wavelets. Discrete Wavelet Transform: Haar scaling functions, Haar wavelet function, Daubechies Wavelets. (Chapters 1, 3 & 4 of Text 2)</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Design adaptive filters for a given application • Design multirate DSP Systems • Implement adaptive signal processing algorithm • Design active networks • Understand advanced signal processing techniques, including multi-rate processing and time-frequency analysis techniques 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. “Digital Signal Processing, Principles, Algorithms and Applications”, JohnG. Proakis, Dimitris G.Manolakis, Fourth edition, Pearson-2007. 2. Insight into Wavelets- from Theory to Practice”, K.P Soman, Ramachandran, Resmi- PHI Third Edition-2010. 	

ADVANCED EMBEDDED SYSTEM [As per Choice Based Credit System (CBCS) scheme] SEMESTER - I			
Subject	18EVE13	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. • Describe the hardware software co-design and firmware design approaches • Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. • Program ARM CORTEX M3 using the various instructions, for different applications. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).</p>			L1, L2, L3
Module -2			
<p>Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).</p>			L1, L2, L3
Module -3			
<p>ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)</p>			L1, L2, L3
Module -4			

Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6).	L1, L2, L3
Module -5	
Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10).	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. • Explain the hardware software co-design and firmware design approaches. • Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. • Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd edn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

DIGITAL CIRCUITS AND LOGIC DESIGN [As per Choice Based Credit System (CBCS) scheme] SEMESTER - I			
Course Code	18ELD14	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits - 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand the concepts of sequential machines • Design Sequential Machines/Circuits • Analyze the faults in the design of circuits • Apply fault detection experiments to sequential circuits 			
Modules			RBT Levels
Module-1			
Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks, Capabilities, Minimization, and Transformation of Sequential Machines: The Finite- State Model, Further Definitions, Capabilities.			L1, L2, L3
Module-2			
Fault Detection by Path Sensitizing, Detection of Multiple Faults, Failure-Tolerant Design, Quadded Logic, Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits.			L1, L2, L3
Module-3			
Fault-Location Experiments, Boolean Differences, Limitations of Finite - State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines.			L1, L2, L3
Module-4			
Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, ELD ecompositions, Synthesis of Multiple Machines.			L1, L2, L3
Module-5			

<p>State Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection.</p>	<p>L1, L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the concepts of sequential machines • Design Sequential Machines/Circuits • Analyze the faults in the design of circuits • Apply fault detection experiments to sequential circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book: Zvi Kohavi, “Switching and Finite Automata Theory”, 2nd Edition, TMH, 2008, ISBN: 978_0_07_099387_7</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Charles Roth Jr., “Digital Circuits and logic Design”, 7thedn, Cengage Learning, 2014. 2. Parag K Lala, “Fault Tolerant And Fault Testable Hardware Design”, Prentice Hall Inc. 1985. 3. E. V. Krishnamurthy, “Introductory Theory of Computer”, Macmillan Press Ltd, 1983 4. Mishra & Chandrasekaran, “Theory of computer science – Automata, Languages and Computation”, 2nd Edition, PHI, 2004. 	

DIGITAL VLSI DESIGN [As per Choice Based Credit System (CBCS) scheme] SEMESTER -I			
Subject	18EVE15	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain VLSI Design Methodologies • Learn Static and Dynamic operation principles, analysis and design of inverter circuit. • Infer state of the art Semiconductors Memory circuits. • Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits. • Illustrate VLSI and ASIC design • Illustrate VLSI and ASIC design. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.</p> <p>MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.</p>			L1, L2
Module -2			
<p>MOS Inverters-Static Characteristics: CMOS Inverter.</p> <p>MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.</p>			L2, L3
Module -3			
<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>			L1, L2, L3

Module -4	
<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	L1,L2, L3
Module -5	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	L2, L3
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Sung Mo Kang & Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, Third Edition.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective”, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000. 2. Wayne, Wolf, “Modern VLSI Design: System on Silicon” Prentice Hall PTR/Pearson Education, Second Edition, 1998. 3. Douglas A Pucknell & Kamran Eshragian, “Basic VLSI Design” PHI 3rd Edition (original Edition – 1994). 	

EMBEDDED SYSTEMS LAB [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Laboratory Code	18ELDL16	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions)+ 03 Hours Laboratory	Exam Marks	60
		Exam Hours	03
CREDITS – 02			
<p>Course objectives: This laboratory course enables students to get practical experience on the</p> <ul style="list-style-type: none"> • Understand the design tool such as Cadence OrCAD/ OrCAD Lite /EDA tool • Design of analog and digital circuits using the simulation tool • Use of assembly level programming for different applications using ARM-CORTEX M3 Kit and Keil uVision-4 tool. • Practice the different concepts and applications of C programming environment with ARM CORTEX M3. 			
Laboratory Experiments			Revised Bloom's Taxonomy (RBT) Level
<p>Part A: EDA Using Cadence OrCAD or OrCAD Lite or any EDA Tool, design and verify the following:</p> <ol style="list-style-type: none"> a) 3½ Digit Digital Voltmeter b) Monolithic function Generator c) Regulated Power supplies d) Batch counter using TTL ICs. e) DAC and ADC f) P, PI, PID and ON/OFF Controllers g) Programmable Timers h) Filters and Resonance Circuits 			L2,L3,L4

<p>PART-B: ARM-CORTEX M3 [Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U]</p> <ol style="list-style-type: none"> a) Write an Assembly language program to calculate 10+9+8+ +1 b) Write a Assembly language program to link Multiple object files and link them together. c) Write a Assembly language program to store data in RAM. d) Write a C program to Output the "Hello World" message using UART. e) Write a C program to Design a Stopwatch using interrupts. f) Write an Exception vector table in C g) Write an Assembly Language Program for locking a Mutex. h) Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values. 	L3
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand the computer aided design tools for the electronic circuit designs. • Design an analog and digital systems using Cadence OrCAD, OrCAD Lite or any EDA tool. • Develop assembly programs for different applications using ARM Cortex M3 and Keil uVision-4 tool. • Develop C Programs for different applications using ARM-Cortex M3 and Keil uVision-4 tool. 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> 1. All laboratory experiments are to be included for practical examination. 2. For examination, two questions using different tool to be set. 3. Students are allowed to pick one experiment from the lot. 4. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. 5. Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero. 	

RESEARCH METHODOLOGY AND IPR [As per Choice Based Credit System (CBCS) scheme] SEMESTER –I			
Course Code	18RMI17	CIE Marks	40
Number of Lecture Hours/Week	02	Exam Hours	03
Total Number of Lecture Hours	25	SEE Marks	60
Credits - 02			
<p>Course objectives:</p> <ul style="list-style-type: none"> • To give an overview of the research methodology and explain the technique of defining a research problem • To explain the functions of the literature review in research. • To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review. • To explain various research designs and their characteristics. • To explain the details of sampling designs, and also different methods of data collections. • To explain the art of interpretation and the art of writing research reports. • To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment. • To discuss leading International Instruments concerning Intellectual Property Rights. ■ 			
Module-1			Teaching Hours/ RBT Level
<p>Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. ■</p>			05 L1, L2
Module-2			
<p>Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.</p> <p>Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. ■</p>			05 L1, L2
Module-3			

<p>Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.</p> <p>Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. ■</p>	<p>05</p> <p>L1, L2</p>
<p>Module-4</p>	
<p>Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.</p> <p>Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout.</p> <p>Interpretation and Report Writing (continued): of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. ■</p>	<p>05</p> <p>L1, L2,</p> <p>L3, L4</p>
<p>Module-5</p>	
<p>Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ■</p>	<p>05</p> <p>L1, L2,</p> <p>L3, L4</p>

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Explain the art of interpretation and the art of writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

M.Tech 2018-Digital Electronics/ Electronics –
SECOND SEMESTER SYLLABUS

ADVANCED COMPUTER ARCHITECTURE [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	18ELD21	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to: <ul style="list-style-type: none"> • Understand the basic concepts for parallel processing • Analyze program partitioning and flow mechanisms • Apply pipelining concept for the performance evaluation • Learn the advanced processor architectures for suitable applications • Know concepts of Parallel Programming 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
Parallel Computer Models: The State of Computing, Multiprocessors and multicomputers, Multivector and SIMD computers. Program and Network Properties: Conditions of parallelism, Program Partitioning & Scheduling, Program Flow Mechanisms.			L1,L2, L3
Module -2			
Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches. Processors & Memory Hierarchy: Advanced processor technology, Super Scalars & Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.			L1,L2, L3,
Module -3			
Bus, Cache and Shared Memory: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential & Weak Consistency Model. Pipelining & Superscalar Technologies: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design, Superscalar Pipeline Design.			L1, L2, L3
Module -4			

<p>Multivector & SIMD Computers: Vector Processing principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organization.</p> <p>Scalable, Multithreaded and Data Flow Computers: Latency Hiding Techniques, Principles of Multithreading, Fine Grain Multi Computers, Scalable and Multithreaded Architectures, Data Flow and Hybrid Architectures.</p>	L1, L2, L3
Module -5	
<p>Parallel Models, Languages and Compilers: Parallel Programming Models, Parallel Languages & Compilers, Dependence Analysis and Data Arrays, Code Optimization and Scheduling, Loop Parallelization and Pipelining.</p> <p>Parallel Program Development and Environments: Parallel Programming Environments, Synchronization and Multi Processor Modes, Shared Variable Program Structures.</p>	L1, L2, L3
<p>Course outcomes: At the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand the basic concepts for parallel processing • Analyze program partitioning and flow mechanisms • Apply pipelining concept for the performance evaluation • Learn the advanced processor architectures for suitable applications • Understand parallel Programming 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book:</p> <p style="padding-left: 40px;">Kai Hwang & Narendra Jotwani, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”, McGraw Hill Education, 3rd Edition, 2016, ISBN: 978-93-392-2092-1.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. M.J. Flynn, “Computer Architecture, Pipelined and Parallel Processor Design”, Narosa Publishing, 2002. 2. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2013. 3. Ananth Grama “ An Introduction to Parallel Computing: Design and Analysis of Algorithms” 2nd Edn., Pearson, 2004. 	

Real Time Operating System [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	18EVE22	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging			L1,L2,L3

Components, Exceptions, assert, Checking return codes, Single-step debugging, Test access ports, Trace Ports. (Text 1: Selected topics from Chap. 8,9)	
Module 5	
Process and Threads: Process and thread creations, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication (Text 2: Chap. 11)	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. • Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC to improve the system performance. • Apply priority based static and dynamic real time scheduling techniques for the given specifications. • Analyze deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. • Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, “Real-Time Embedded Systems and Components”, Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, Dream Tech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, “Real Time System”, Pearson education, 2008. 2. Dream Tech Software Team, “Programming for Embedded Systems”, John Wiley, India Pvt. Ltd., 2008. 	

ERROR CONTROL CODING [As per Choice Based Credit System (CBCS) Scheme] SEMESTER – 2			
Subject Code	18ECS23	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the concept of the Entropy, information rate and capacity for the Discrete memoryless channel. • Apply modern algebra and probability theory for the coding. • Compare Block codes such as Linear Block Codes, Cyclic codes etc and Convolutional codes. • Detect and correct errors for different data communication and storage systems. • Implement different Block code encoders and decoders. • Analyze and implement convolutional encoders and decoders. • Analyze and apply soft and hard Viterbi algorithm for decoding of convolutional codes. 			
Modules			RBT Level
Module 1			
<p>Information theory: Introduction, Entropy, Source coding theorem, discrete memoryless channel, Mutual Information, Channel Capacity Channel coding theorem.(Chap. 5 of Text 1)</p> <p>Introduction to algebra: Groups, Fields, binary field arithmetic, Construction of Galois Fields $GF(2^m)$ and its properties, (Only statements of theorems without proof) Computation using Galois field $GF(2^m)$ arithmetic, Vector spaces and Matrices. (Chap. 2 of Text 2)</p>			L1,L2,L3
Module 2			
<p>Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, Single Parity Check Codes (SPC), Repetition codes, Self dual codes, Hamming codes, Reed-Muller codes. Product codes and Interleaved codes. (Chap. 3 of Text 2)</p>			L1,L2,L3
Module 3			
<p>Cyclic codes: Introduction, Generator and parity check polynomials, Encoding of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes, Error trapping Decoding, Cyclic hamming codes, Shortened cyclic codes.(Chap. 4 of Text2)</p>			L1,L2,L3
Module 4			
<p>BCH codes: Binary primitive BCH codes, Decoding procedures,</p>			

<p>Implementation of Galois field arithmetic. (Chap. 6 (6.1,6.2,6.7) of Text 2)</p> <p>Primitive BCH codes over GF (q), Reed -Solomon codes. (Chap. 7 (7.2,7.3) of Text 2)</p> <p>Majority Logic decodable codes: One -step majority logic decoding, Multiple-step majority logic. (Chap. 8 (8.1,8.4) of Text 2)</p>	L1,L2,L3
Module 5	
<p>Convolution codes: Encoding of convolutional codes: Systematic and Nonsystematic Convolutional Codes, Feedforward encoder inverse, A catastrophic encoder, Structural properties of convolutional codes: state diagram, state table, state transition table, tree diagram, trellis diagram.</p> <p>Viterbi algorithm, Sequential decoding: Log Likelihood Metric for Sequential Decoding. (11.1,11.2, 12.1,13.1 of Text 2)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Analyse a discrete memoryless channel, given the source and transition probabilities. • Apply the concept of modern linear algebra for the error control coding technique. • Construct and Implement efficient LBC, Cyclic codes etc encoder and decoders. • Apply decoding algorithms for efficient decoding of Block codes and Convolutional codes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Simon Haykin, "Digital Communication systems", First edition, Wiley India Private. Ltd, 2014. ISBN 978-81-265-4231-4 2. Shu Lin and Daniel J. Costello. Jr, "Error control coding", Pearson, Prentice Hall, 2nd edition, 2004. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Blahut. R. E, "Theory and practice of error control codes", Addison Wesley, 1984. 2. Salvatore Gravano, "Introduction to Error control coding", Oxford university press, 2007. 3. Bernard Sklar, "Digital Communications - Fundamentals and Applications", 2nd Edition Pearson Education (Asia) Pvt. Ltd, 2001. 	

DIGITAL CIRCUITS SIMULATION LAB [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Laboratory Code	18ELDL26	CIE Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions)+ 03 Hours Laboratory	SEE Marks	60
		Exam Hours	03
CREDITS – 02			
<p>Course objectives: This laboratory course enables students to</p> <ul style="list-style-type: none"> • Design and simulate digital electronic circuits using graphical programming tool LabVIEW. • Create user friendly interfaces using LabVIEW and analyze the input and output data for various digital circuits. • Understand the FPGA Design and testing for digital circuits • Design of digital circuits using Verilog programming • Verification and performance testing of digital circuits 			
Laboratory Experiments			Revised Bloom's Taxonomy (RBT) Level
<p>PART-A: Graphical Programming using LabVIEW</p> <ol style="list-style-type: none"> a) Design of 4 bit Adders (CLA, CSA, CMA, Parallel adders) b) Design of Binary Subtractors c) Design of Encoder (8X3), Decoder(3X8) d) Design of Multiplexer (8X1), and Demultiplexer (1X8) e) Design of code converters & Comparator f) Design of FF (SR, D, T, JK, and Master Slave with delays) g) Design of registers using latches and flip-flops h) Design of 8 bit Shift registers i) Design of Asynchronous & Synchronous Counters 			L3

<p>2. Develop Verilog Program for design and testing the following digital circuits (for 4/8 bits) using FPGA/CPLD. Use logic analyzer/Chipscope for the verification of results.</p> <p>(Note: Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro. Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits.)</p> <ol style="list-style-type: none"> Carry skip and carry look ahead adder BCD adder and subtractor Array Multiplication (signed and unsigned) Booth multiplication (radix-4) Magnitude comparator LFSR Parity generator Universal Shift Register Sequence generation (11101 say) using Mealy/Moore FSM 	<p>L2, L3, L4</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> Simulate the digital circuits using graphical programming tool LabVIEW. Build user friendly interfaces to interact with the digital circuits and to observe the outputs. Develop Verilog Programs for Digital Circuit design simulation and implement digital systems on FPGA/CPLD Testing and validation of digital systems using Logic analyzer/Chipscope 	
<p>Conduct of Practical Examination:</p> <ol style="list-style-type: none"> All laboratory experiments are to be included for practical examination. For examination, one question each to be set from PART-A and PART-B. Students are allowed to pick one experiment from the lot. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. Change of experiment is allowed only once and Marks allotted to the procedure part will be made zero. 	

Professional Elective 1

Wireless Sensor Networks [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Course Code	18ECS241	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
Course Outcomes:			
At the end of this course, students will be able to			
<ul style="list-style-type: none"> • Understand the hardware details of different types of sensors and select right type of sensor for various applications. • Understand conversion of sensor information into digital data and packetize to a specific protocol for Transmission • Understand radio standards and communication protocols to be used for wireless sensor. • Understand the issues involved in synchronization and security. 			
Modules			RBT Levels
Module-1			
Motivation for a Network of Wireless Sensor Nodes Sensing and Sensors, Wireless Sensor Networks, Challenges and Constraints (Chapt 1 till 1.2.7) Applications: Structural Health Monitoring (till 2.1.4), Traffic Control (2.2), Health Care (2.3), Pipeline Monitoring (2.4), Precision Agriculture (2.5)			L1, L2, L3
Module-2			
Sensing Node Architecture: The Sensing Subsystem (3.1), The Processor (3.2) Subsystem (3.2) (in brief only), Communication Interfaces (3.3), Prototypes (3.4) Medium Access Control : Overview - Contention-Free Medium Access, Contention-Based Medium Access (6.1), Wireless MAC Protocols – CSMA, MACA and MACAW, MACA By Invitation, IEEE 802.11, IEEE 802.15.4 and ZigBee (6.2), Characteristics of MAC Protocols in Sensor Networks (6.3), Contention-Free MAC Protocols (6.4), Contention-Based MAC Protocols (6.5), Hybrid MAC Protocols (6.6)			L1, L2, L3
Module-3			
Network Layer: 7.1 Overview , 7.2 Routing Metrics, 7.3 Flooding and Gossiping, 7.4 Data-Centric Routing, 7.5 Proactive Routing, 7.6 On-Demand Routing, 7.8 Location-Based Routing , 7.9 QoS-Based Routing Protocols			L1, L2, L3
Module-4			

<p>Power management: 8.1 Local Power Management Aspects, 8.2 Dynamic Power Management, 8.3 Conceptual Architecture.</p> <p>Time Synchronization: 9.1 Clocks and the Synchronization Problem, 9.2 Time Synchronization in Wireless Sensor Networks, 9.3 Basics of Time Synchronization, 9.4 Time Synchronization Protocols till (9.4.5)</p>	L1, L2, L3
Module-5	
<p>Localization: 10.1 Overview, 10.2 Ranging Techniques, 10.3 Range-Based Localization, 10.4 Range-Free Localization, 10.5 Event-Driven Localization.</p> <p>Network Security: 11.1 Fundamentals of Network Security, 11.2 Challenges of Security in Wireless Sensor Networks, 11.3 Security Attacks in Sensor</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <p>CO1: Explain the concepts of sensors and conversion to digitally formatted signal for transmission.</p> <p>CO2: Evaluate the capacity and degradation in performance of various wireless MAC protocols in a transmission environment.</p> <p>CO3: Analyze schemes to transport sensor data to a server in a power efficient and time efficient manner.</p> <p>CO4: Develop and evaluate the performance of a sensor network including localization of sensor faults.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as see marks is 60. 	
<p>Text Book:</p> <p>1. Waltenegus Dargie and Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley & Sons Ltd. ISBN 978-0-470-99765-9, 2010.</p> <p>Reference Book:</p> <p>1. Ian F. Akyildiz and Mehmet Can Vuran “Wireless Sensor Networks”, John Wiley & Sons Ltd. ISBN 978-0-470-03601-3 (H/B), 2010.</p>	

Professional Elective 2

SoC DESIGN			
[As per Choice Based credit System (CBCS) Scheme			
SEMESTER – II			
Subject Code	18EVE252	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Describe the ARM processor architecture and user-level assembly language programming • Appreciate what a high-level language (in this case, C) really needs and how those needs are met by the ARM instruction set. • raises the issues involved in debugging systems which use embedded processor cores and in the production testing of board-level systems. • Learn the concept of memory hierarchy, discussing the principles of memory management and caches. 			
Modules			RBT Level
Module 1			
<p>ARM Organization and Implementation: 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface. The ARM Instruction Set : Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instruction, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions, Coprocessor instructions, Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture v5T only), Unused instruction space, Memory faults, ARM architecture variants.</p>			L1,L2
Module 2			
<p>Architectural Support for High-Level Languages: Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, Use of memory, Run-time environment. Architectural Support for System Development: The ARM</p>			L1,L2

memory interface, The Advanced Microcontroller Bus Architecture (AMBA), The ARM reference peripheral specification, Hardware system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, Embedded Trace, Signal processing support.	
Module 3	
ARM Processor Cores: ARM7TDMI, ARM8,ARM9TDMI, ARM10TDMI ,Discussion ,Example and exercises. Memory Hierarchy: Memory size and speed, On-chip memory, Caches, Cache design - an example, Memory management, Examples and exercises.	L1,L2
Module 4	
Architectural Support for Operating Systems: An introduction to operating systems, The ARM system control coprocessor, CP15 protection unit registers, ARM protection unit,CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/ Output, Example and exercises. ARM CPU Cores: The ARM710T, ARM720T and ARM740T, The ARM810,The Strong ARM SA-110,The ARM920T and ARM940T,The ARM946E-S and ARM966E-S,The ARM1020E,Discussion,Example and exercises.	L1,L2
Module 5	
Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The One C TM VWS22100 GSM chip, The Ericsson-VLSI Bluetooth Baseband Controller, The ARM7500 and ARM7500FE, The ARM7100 364,The SA-1100 368,Examples and exercises. The AMULET Asynchronous ARM Processors: Self-timed design 375,AMULET1 377,AMULET2 381,AMULET2e 384,AMULET3 387,The DRACO telecommunications controller 390, A self-timed future? 396, Example and exercises.	L1,L2,L3
Course Outcomes: After studying this course, students will be able to: 1. Apply the 3- and 5-stage pipeline ARM processor cores and analyse the implementation issues. 2. Use the concepts and methodologies employed in designing a System- on-chip (SoC) based around a microprocessor core and in designing the microprocessor core itself. 3. Understand how SoCs and microprocessors are designed and used, and why a modern processor is designed the way that it is. 4. Use integrated ARM CPU cores (including StrongARM) that incorporate full support for memory management. 5. Analyze the requirements of a modern operating system and use the ARM architecture to address the same.	
Question paper pattern: <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. 	

- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

Text Book:

- Steve Furber, “ARM System-On-Chip Architecture”, Addison Wesley, 2nd edition.

References Books:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd edn, Newnes, (Elsevier), 2010.
2. Sudeep Pasricha and Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufmann, Publishers © 2008.
3. Michael Keating, Pierre Bricaud, “Reuse Methodology Manual for System on Chip designs”, Kluwer Academic Publishers, 2nd edition, 2008.

M.Tech 2018-Digital Electronics/ Electronics -
THIRD SEMESTER SYLLABUS

<u>SYNTHESIS AND OPTIMIZATION OF DIGITAL CIRCUITS</u> [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Course Code	18ELD31	CIA Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Understand the need for optimization and dimensions of optimization for digital circuits. • Understand basic optimization techniques used in circuits design • Understand advanced tools and techniques in digital systems design including Hardware Modeling and Compilation Techniques. • Explain details of Logic-Level synthesis and optimization techniques for combinational and sequential circuits. • Explain the concept of scheduling and resource binding for optimization. 			
Modules			RBT Levels
Module-1			
<p>Introduction to Synthesis and optimization: Design of Microelectronics circuits, Computer aided Synthesis and Optimization.</p> <p>Hardware Modeling: HDLs for Synthesis, Abstract models, Compilation and Behavioral Optimization. (Text1: Topics from Chap.1,3)</p>			L1, L2, L3
Module-2			
<p>Graph theory for CAD for VLSI: Graphs, Combinatorial Optimization, Graph Optimization problems and Algorithms, Boolean Algebra and Applications.</p> <p>Architectural Synthesis and Optimization: Fundamental Architectural Synthesis problems, Area and Performance Estimation, Strategies for Architectural Optimization, Datapath Synthesis, Control Path Synthesis.(Text1: Topics From Chap. 2,4)</p>			L1, L2, L3
Module-3			
<p>Two level Combinational Logic Optimization: Introduction, Logic Optimizations, Operations on Two level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems.</p> <p>Multiple Level Combinational Logic Optimization:</p>			L1, L2, L3

Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model. (Text1: Chap. 7, 8)	
Module-4	
Sequential Logic Optimization: Introduction, Sequential Logic Optimization using State based Models, Sequential Logic Optimization using Network Models, Implicit FSM Traversal Methods, Testability concerns for Synchronous Circuits. (Text 1: Chap. 9)	L1, L2, L3
Module-5	
Scheduling Algorithms: Introduction, A Model for Scheduling problems, Scheduling with Resource Constraints, Scheduling without Resource Constraints, Scheduling Algorithms for Extended Sequencing Models, Scheduling Pipelined Circuits. Resource Sharing and Binding: Sharing and Binding for Resource dominated circuits, Sharing and Binding for General Circuits, Concurrent Binding and Scheduling. (Text1: Chap. 5,6)	L1, L2, L3
Course Outcomes: After studying this course, students will be able to:	
<ul style="list-style-type: none"> • Understand the process of synthesis and optimization in a top down approach for digital circuits models using HDLs. • Understand the terminologies of graph theory and its algorithms to optimize a Boolean equation. • Apply different two level and multilevel optimization algorithms for combinational circuits • Apply the different sequential circuit optimization methods using state models and network models. • Apply different scheduling algorithms with resource binding and without resource binding for pipelined sequential circuits and extended sequencing models. 	
Question paper pattern:	
<ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
Text Book:	
Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits", Tata McGraw-Hill, 2003.ISBN: 9780070582781	
Reference Books:	
Edwards M.D., Automatic Logic synthesis Techniques for Digital Systems, Macmillan New Electronic Series, 1992.	

Professional Elective 3

Advances in Image Processing [As per Choice Based credit System (CBCS) Scheme SEMESTER – III			
Subject Code	18ECS321	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours Per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
1. Acquire fundamental knowledge in understanding the representation of the digital image and its properties			
2. Equip with some pre-processing techniques required to enhance the image for further analysis purpose.			
3. Select the region of interest in the image using segmentation techniques.			
4. Represent the image based on its shape and edge information.			
5. Describe the objects present in the image based on its properties and structure.			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons			L1, L2, L3

and object marking, Morphological segmentations and watersheds.	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the representation of the digital image and its properties 2. Apply pre-processing techniques required to enhance the image for its further analysis. 3. Use segmentation techniques to select the region of interest in the image for analysis 4. Represent the image based on its shape and edge information. 5. Describe the objects present in the image based on its properties and structure. 6. Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, Cengage Learning, 2013, ISBN: 978-81-315-1883-0 <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010 2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011. 	

Professional Elective 4

Internet of Things [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Course Code	18ECS333	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Introduce concept of IOT and its applications in today’s scenario. • Understand IOT content generation and transport through networks • Understand the devices employed for IOT data acquisition and communication access technologies • Introduce some use cases of IOT 			
Module-1			RBT
<p>What is IOT Genesis, Digitization, Impact, Connected Roadways, Buildings, Challenges</p> <p>IOT Network Architecture and Design Drivers behind new network Architectures, Comparing IOT Architectures, M2M architecture, IOT world forum standard, IOT Reference Model, Simplified IOT Architecture.</p>			L1, L2
Module-2			
<p>IOT Network Architecture and Design Core IOT Functional Stack, Layer1(Sensors and Actuators) , Layer 2(Communications Sublayer), Access network sublayer, Gateways and backhaul sublayer, Network transport sublayer, IOT Network management. Layer 3(Applications and Analytics) – Analytics vs Control, Data vs Network Analytics IOT Data Management and Compute Stack</p>			L2,L3
Module-3			
<p>Engineering IOT Networks Things in IOT – Sensors, Actuators, MEMS and smart objects. Sensor networks, WSN, Communication protocols for WSN Communications Criteria, Range Frequency bands, power consumption, Topology, Constrained Devices, Constrained Node Networks IOT Access Technologies, IEEE 802.15.4 Competitive Technologies – Overview only of IEEE 802.15.4g, 4e, IEEE 1901.2a Standard Alliances – LTE Cat0, Cat-M, NB-IOT</p>			L2,L3
Module-4			

<p>Engineering IOT Networks IP as IOT network layer, Key Advantages, Adoption, Optimization, Constrained Nodes, Constrained Networks, IP versions, Optimizing IP for IOT. Application Protocols for IOT – Transport Layer, Application Transport layer, Background only of SCADA, Generic web based protocols, IOT Application Layer Data and Analytics for IOT – Introduction, Structured and Unstructured data, IOT Data Analytics overview and Challenges.</p>	L3,L4
Module-5	
<p>IOT in Industry (Three Use cases)</p> <ul style="list-style-type: none"> • IOT Strategy for Connected manufacturing, Architecture for Connected Factory • Utilities – Power utility, IT/OT divide, Grid blocks reference model, Reference Architecture, Primary substation grid block and automation. • Smart and Connected cities –Strategy, Smart city network Architecture, Street layer, city layer, Data center layer, services layer, Smart city security architecture, Smart street lighting. 	L3,L4
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the basic concepts IOT Architecture and devices employed. • Analyze the sensor data generated and map it to IOT protocol stack for transport. • Apply communications knowledge to facilitate transport of IOT data over various available communications media. • Design a use case for a typical application in real life ranging from sensing devices to analyzing the data available on a server to perform tasks on the device. 	
<p>Text Book: Cisco, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017). ISBN-10: 9386873745, ISBN-13: 978-9386873743</p>	
<p>Reference Books: Arshdeep Bahga and Vijay Madisetti, 'Internet of Things – A Hands on Approach', Orient Blackswan Private Limited - New Delhi; First edition (2015), ISBN-10: 8173719543, ISBN-13: 978-8173719547</p>	

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. VLSI Design and Embedded Systems

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD11	Advanced Mathematics	4	2	3	50	100	150	4
14EVE12	Digital VLSI Design	4	2	3	50	100	150	4
14EVE13	Advanced Embedded Systems	4	2	3	50	100	150	4
14EVE14	VLSI Process Technology	4	2	3	50	100	150	4
14EVE15X	Elective - 1	4	2	3	50	100	150	4
14EVE16	VLSI Design and Embedded System Lab -1	--	3	3	25	50	75	2
14EVE17	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective-1:

14 ELD151	Digital System Design using Verilog
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II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14EVE21	Design of Analog and Mixed mode VLSI Circuits	4	2	3	50	100	150	4
14EVE22	Low Power VLSI Design	4	2	3	50	100	150	4
14EVE23	VLSI Testing and Verification	4	2	3	50	100	150	4
14ELD 24	Real Time Operating Systems	4	2	3	50	100	150	4
14EVE25X	Elective-2	4	2	3	50	100	150	4
14EVE26	VLSI Design and Embedded System Lab -2		3	3	25	50	75	2
14EVE27	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
**Project Phase-I(6 week Duration)								
Total		20	16	18	300	550	850	23

Elective-2:

14 EVE 255	SOC Design
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**** Between the II Semester and III Semester, after availing a vocation of 2 weeks.**

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M.Tech. VLSI Design and Embedded Systems

III Semester: INTERNSHIP #

CREDIT BASED

Course Code	Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14EVE31	Midterm Presentation on Internship (After 8 weeks from the date of commencement) *	-	-	-	25	-	25	4
14EVE32	Report on Internship (After 16 weeks from the date of commencement)	-	-	-	75		75	12
14EVE33	Evaluation and Viva-voce	-	-	3	-	50	50	4
	Total	-	-	-	100	50	150	20

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

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IV Semester

CREDIT BASED

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14EVE41	Synthesis and Optimization of Digital Circuits	4	2					
14EVE42X	Elective-3	4	2					
14EVE43	Evaluation of Project Phase-I	-	-	-	25	-	25	1
14EVE44	Phase-II : Midterm evaluation of Project #	-	-	-	25	-	25	1
14EVE45	Evaluation of Project Work and Viva-voce	-	-	3	-	100+100	200	18
Total		8	04	09	150	400	550	28
Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits								

Elective-3:

14 EVE 421	Advances in VLSI Design
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Note:

- 1) Project Phase – I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalize the topic of dissertation.
- 2) Project Phase – II: 16 weeks duration during III Semester. Evaluation shall be taken during the Second week of the IV Semester. Total Marks shall be 25.
- 3) Project Evaluation: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 250 (Phase I Evaluation: 25 Marks, Phase –II Evaluation: 25 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase – I & II shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (Out of two external examiners at least one should be present).

Advanced Mathematics

Subject Code	: 14ELD11	IA Marks	: 50
No. of Lecture Hours / Week	: 04	Exam. Hours	: 03
Total No. of Lecture Hours	: 50	Exam. Marks	: 100

Matrix Theory

QR EL Decomposition – Eigen values using shifted QR algorithm- Singular Value EL Decomposition - Pseudo inverse- Least square approximations

Calculus of Variations

Concept of Functionals- Euler's equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Isoperimetric problems- Variational problems with moving boundaries

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of a elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi infinite rod.

Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions

Reference Books:

1. Richard Bronson, "**Schaum's Outlines of Theory and Problems of Matrix Operations**", McGraw-Hill, 1988.

2. Venkataraman M K, "**Higher Engineering Mathematics**", National Pub. Co, 1992.
3. Elsgolts, L., "**Differential Equations and Calculus of Variations**", Mir, 1977.
4. Sneddon, I.N., "**Elements of Partial differential equations**", Dover Publications, 2006.
5. Sankara Rao, K., "**Introduction to partial differential equations**", Prentice – Hall of India, 1995
6. Taha H A, "**Operations research - An introduction**", McMillan Publishing co, 1982.

Digital VLSI Design

Subject Code : 14EVE12
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.

MOS Inverters: Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load, CMOS Inverter.

MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Dynamic Logic Circuits : Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).

Low-Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low-Power Design Through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance, Adiabatic Logic Circuits.

BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.

Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.

Design for Manufacturability : Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modelling, Parametric Yield Estimation, Parametric Yield Maximization, Worst-Case Analysis, Performance Variability Minimization.

Reference Books:

1. Sung Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, Third Edition.
2. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective", Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.

Advanced Embedded Systems

Subject Code : 14EVE13
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Typical Embedded System : Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs.

Embedded Hardware Design and Development :EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation , PCB Layout Design – Building blocks, Component placement, PCB track routing.

ARM -32 bit Microcontroller family. Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture.

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages

Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/ELDompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Reference Books:

1. Shibu K V, **“Introduction to Embedded Systems”**, Tata McGraw Hill Education Private Limited, 2009
2. Joseph Yiu, **“The Definitive Guide to the ARM Cortex-M3”**, Newnes, (Elsevier), 2008.
3. James K Peckol, **“Embedded Systems – A contemporary Design Tool”**, John Wiley, 2008.

VLSI Process Technology

Subject Code : 14EVE14
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Crystal Growth and Wafer Preparation: Introduction, Electronic-Grade Silicon, Czochralski Crystal Growing, Silicon Shaping, Process Considerations.

Epitaxy: Introduction, Vapour-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation.

Lithography: Introduction, Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography.

Reactive Plasma Etching: Introduction, Plasma Properties, Feature-Size Control and Anisotropic Etch Mechanisms, Other Properties of Etch Processes, Reactive Plasma-Etching Techniques and Equipment, Specific Etch Processes.

Dielectric and Polysilicon Film Deposition: Introduction, Deposition Processes, Polysilicon, Silicon Dioxide, Silicon Nitride, Plasma-Assisted Depositions, Other Materials.

Ion Implantation: Introduction, Range Theory, Implantation Equipment, Annealing, Shallow Junctions, High-Energy Implantation.

Metallization: Introduction, Metallization Applications, Metallization Choices, Physical Vapor Deposition, Patterning, Metallization Problems, New Role of Metallization.

VLSI Process Integration: Introduction, Fundamental Considerations for IC Processing, NMOS IC technology, CMOS IC Technology, MOS Memory IC Technology, Bipolar IC Technology, IC Fabrication.

Packaging of VLSI Devices: Introduction, Package Types, Packaging Design Considerations.

Reference Books:

1. S. M. Sze, "VLSI Technology", McGraw-Hill, Second Edition.
2. S.K. Ghandhi, "VLSI Fabrication Principles", John Wiley Inc., New York, 1994, Second Edition.

Digital System Design Using Verilog

Subject Code : 14 ELD151
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.

Combinational Basics: Boolean Functions and Boolean Algebra, Binary Coding, Combinational Components and Circuits, Verification of Combinational Circuits.

Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers.

Sequential Basics: Storage elements, Counters, Sequential Datapaths and Control, Clocked Synchronous Timing Methodology.

Memories: Concepts, Memory Types, Error Detection and Correction.

Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.

Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory.

I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.

Accelerators: Concepts, case study, Verification of accelerators.

Design Methodology: Design flow, Design optimization, Design for test.

REFERENCE BOOKS:

1. Peter J. Ashenden, “**Digital Design: An Embedded Ssystems Approach Using VERILOG**”, Elsevier, 2010.

VLSI Design and Embedded System Lab -1

Subject Code : 14EVE16
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 50
Exam Hours : 03
Exam Marks : 50

VLSI Digital Design

ASIC-Digital Design Flow

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library(**constraints to be given**). Do the initial timing verification with gate level simulation.

1. An inverter, Buffer and Transmission gate
2. Basic/universal gates
3. Flip flop -RS, D, JK, MS, T
4. Serial & Parallel adder
5. 4-bit counter [Synchronous & Asynchronous counter]

FPGA DIGITAL DESIGN

VLSI Front End Design programs:

Programming can be done using any compiler. Download the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro apart from verification by simulation with any of the front end tools

1. Write Verilog code for the design of 8-bit
 - i. Carry Ripple Adder
 - ii. Carry LookAhead adder
 - iii. Carry Skip Adder
 - iv. BCD Adder & Subtractor

2. Write Verilog Code for 8-bit
 - i. Array Multiplication (Signed and Unsigned)
 - ii. Booth Multiplication (Radix-4)
3. Write Verilog code for 4/8-bit
 - i. Magnitude Comparator
 - ii. LFSR
 - iii. Parity Generator
 - iv. Universal Shift Register
4. Write Verilog Code for 3-bit Arbitrary Counter to generate 0,1,2,3,6,5,7 and repeats.
5. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence.
Eg 11101 (with and without overlap) any sequence can be specified
6. Design a FIFO and LIFO buffers in Verilog and Verify its Operation.
7. Design a coin operated public Telephone unit using Mealy FSM model with following operations
 - i. The calling process is initiated by lifting the receiver.
 - ii. Insert 1 Rupee Coin to make a call.
 - iii. If line is busy, placing the receiver on hook should return a coin
 - iv. If line is through, the call is allowed for 60 seconds at the 45th second prompt another 1 Rupee coin to be inserted, to continue the call.
 - v. If user doesn't insert the coin within 60 seconds the call should be terminated.
 - vi. The system is ready to accept new call request when the receiver is placed on the hook.
 - vii. The FSM goes 'out of order' state when there is a Line Fault.

Note: Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits

Embedded Systems:

1. Use any EDA (Electronic Design Automation) tool to learn the Embedded Hardware Design and for PCB design.
2. Familiarize the different entities for the circuit diagram design.

3. Familiarize with the layout design tool, building blocks, component placement, routings, design rule checking etc.

ARM-CORTEX M3

[Programming to be done using Keiluvision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U].

1. Write an Assembly language program to calculate $10+9+8+ \dots +1$
2. Write a Assembly language program to link Multiple object files and link them together.
3. Write a Assembly language program to store data in RAM.
4. Write a C program to Output the "Hello World" message using UART.
5. Write a C program to Design a Stopwatch using interrupts.
6. Write an Exception vector table in C
7. Write an Assembly Language Program for locking a Mutex.
8. Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values.

Design of Analog and Mixed Mode VLSI Circuits

Subject Code : 14 EVE21
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.

Single stage Amplifier: CS stage with resistance load, divide connected load, current source load, triode load, CS stage with source degeneration, source follower, common-gate stage, cascade stage, choice of device models.

Frequency response of CS stage: source follower, Common gate stage, Cascade stage and Difference pair. Noise in CS stage, C- G stage, source follower, cascade stage, differential pair.

Differential Amplifiers & Current Mirrors: Basic difference pair, common mode response, Differential pair with MOS loads, Gilbert cell. Basic current mirrors, Cascade mirrors, active current mirrors.

Operational Amplifiers: One Stage OP-Amp. Two Stage OP-Amp, Gain boosting, Common Mode Feedback, Slew rate, Power Supply Rejection, Noise in Op Amps.

Oscillators and Phase Locked Loops: Ring Oscillators, LC Oscillators, VCO, Mathematical Model of VCO. Simple PLL, Charge pump PLL, Non-ideal effects in PLL, Delay locked loops and applications.

Bandgap Refernces and Switched capacitor Circuits: General Considerations, Supply Independent biasing, PTAT Current Generation, Constant Gm Biasing, Sampling Switches, Switched Capacitor Amplifiers.

Data Converter Architectures: DAC & ADC Specifications, Resistor String DAC, R-2R Ladder Network, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

Reference Book:

1. “Design of Analog CMOS Integrated Circuits”, Behzad Razavi, TMH, 2007.

Low Power VLSI Design

Subject Code : 14 EVE22
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Low Power Design Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library.

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

Reference Books:

1. Kaushik Roy, Sharat Prasad, “**Low-Power CMOS VLSI Circuit Design**” Wiley, 2000
2. Gary K. Yeap, “**Practical Low Power Digital VLSI Design**”, KAP, 2002

3. Rabaey, Pedram, "**Low Power Design Methodologies**" Kluwer Academic, 1997

VLSI Testing and Verification

Subject Code : 14 EVE23
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction to Testing: Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends Affecting Testing. Faults in Digital Circuits: Failures and Faults, Modeling of Faults, Temporary Faults.

Test Generation for Combinational Logic Circuits: Fault Diagnosis of Digital Circuits, Test Generation Techniques for Combinational Circuits, Detection of Multiple Faults in Combinational Logic Circuits.

Design of Testable Sequential Circuits: Controllability and Observability, Ad Hoc Design Rules for Improving Testability, Design of Diagnosable Sequential Circuits, The Scan-Path Technique for Testable Sequential Circuit Design, Level-Sensitive Scan Design, Random Access Scan Technique, Partial Scan, Testable Sequential Circuit Design Using Nonscan Techniques, CrossCheck, Boundary Scan.

Built-In Self Test: Test Pattern Generation for BIST, Output Response Analysis, Circular BIST, BIST Architectures.

Testable Memory Design: RAM Fault Models, Test Algorithms for RAMs, Detection of Pattern Sensitive Faults, BIST Techniques for Ram Chips, Test Generation and BIST for Embedded RAMs.

Importance of Design Verification: What is verification? What is attest bench? The importance of verification, Reconvergence model, Formal verification, Equivalence checking, Model checking, Functional verification.[Ref4- Chapter1]

Verification Tools: Linting tools: Limitations of linting tools, linting verilog source code, linting VHDL source code, linting OpenVera and e-source code, code reviews. Simulators: Stimulus and response, Event based simulation, cycle based simulation, Co-simulators, verification intellectual property: hardware modelers, waveform viewers.[Ref4-Chapter2]

The verification plan: The role of verification plan: specifying the verification plan, defining the first success. Levels of verification: unit level verification, reusable components verification, ASIC and FPGA verification, system level verification, board level verification, verifying strategies, verifying responses. [Ref4-Chapter3]

Static Timing Verification: Concept of static timing analysis. Cross talk and noise. Limitations of STA. slew of a wave form, Skew between the signals, Timing arcs and unateness, Min and Max timing paths, clock domains, operating conditions, critical path analysis, falsepaths, Timing models. [Ref5 Chapter 1, 2, 3, 8]

Physical Design Verification: Layout rule checks and electrical rule checks. Parasitic extraction. Antenna, Crosstalk and Noise: Cross talk glitch analysis, crosstalk delayanalysis, timing verification [Ref6 Chapter 8]

Reference Books:

1. P. K. Lala, “**Digital Circuit Testing and Testability**”, Academic Press
2. M.L. Bushnell and V.D. Agrawal, “**Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits**”, Kluwar Academic Publishers.
3. M. Abramovici, M.A. Breuer and A.D. Friedman, "**Digital Systems and Testable Design**", Jaico Publishing House, 2002.
4. JanickBergeron, “**Writing testbenches: functional verification of HDL models**”, 2nd edition ,Kluwer Academic Publishers,2003
5. JayaramBhasker,RakeshChadha ,“**Static Timing Analysis for Nanometer Designs**” A practical approach, Springer publications
6. PrakashRashinkar, PeterPaterson,Leena Singh “**System on a Chip Verification**”, Kulwer Publications.
7. <http://www.cse.psu.edu/~vijay/verify/instructors.html>

Real Time Operating Systems

Subject Code : 14 ELD24
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction to Real-Time Embedded Systems: Brief history of Real Time Systems, A brief history of Embedded Systems.

System Resources: Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

Processing: Preemptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies.

I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.

Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.

Multi-resource Services: Blocking, Deadlock and livelock, Critical sections to protect shared resources, priority inversion

Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services.

Embedded System Components: Firmware components, RTOS system software mechanisms, Software application components.

Debugging Components: Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self test and diagnostics, External test equipment, Application-level debugging.

Performance Tuning: Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

High availability and Reliability Design: Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design.

Design of RTOS – PIC microcontroller. (Chap 13 of book Myke Predko)

Reference Books:

1. “**Real-Time Embedded Systems and Components**”, Sam Siewert, Cengage Learning India Edition, 2007.

2. “Programming and Customizing the PIC microcontroller”, Myke Predko, 3rd Ed, TMH, 2008.
3. “**Programming for Embedded Systems**”, Dreamtech Software Team, Jhon Wiley, India Pvt. Ltd., 2008.

SoC Design

Subject Code : 14EVE255
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Goal of the course – Today, VLSI chips are entire “system-on-chip” designs, which include processors, memories, peripheral controllers, and connectivity sub-systems. The course aims to provide an appreciation for the motivation behind SoC design, the challenges of SoC design, and the overall SoC design flow.

Motivation for SoC Design - Review of Moore’s law and CMOS scaling, benefits of system-on-chip integration in terms of cost, power, and performance. Comparison on System-on-Board, System-on-Chip, and System-in-Package. Typical goals in SoC design – cost reduction, power reduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap – IP based design and design reuse.

System On Chip Design Process: A canonical SoC Design, SoC Designflow, waterfall vs spiral, top down vs bottom up, Specification requirement, Types of Specification, System Design Process, System level design issues, Soft IP vs Hard IP, IP verification and Integration, Hardware-Software codesign, Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc.

Embedded Memories –cache memories, flash memories, embedded DRAM. Topics related to cache memories. Cache coherence. MESI protocol and Directory-based coherence.

Interconnect architectures for SoC. Bus architecture and its limitations. Network on Chip (NOC) topologies. Mesh-based NoC. Routing in an NoC. Packet switching and wormhole routing.

MPSoCs: What, Why, How MPSoCs, Techniques for designing MPSoCs, Performance and flexibility for MPSoCs design

Case Study: A Low Power Open Multimedia Application Platform for 3G Wireless.

Reference Books:

1. Sudeep Pasricha and Nikil Dutt, "**On-Chip Communication Architectures: System on Chip Interconnect**", Morgan Kaufmann Publishers © 2008.
2. Rao R. Tummala, Madhavan Swaminathan, "**Introduction to system on package sop- Miniaturization of the Entire System**", McGraw-Hill, 2008.
3. James K. Peckol, "**Embedded Systems: A Contemporary Design Tool**", Wiley Student Edition.
4. Michael Keating, Pierre Bricaud, "**Reuse Methodology Manual for System on Chip designs**", Kluwer Academic Publishers, 2nd edition, 2008.
5. Sung-Mo Kang, Yusuf Leblebici, "**CMOS Digital Integrated Circuits**", Tata Mcgraw-Hill, 3rd Edition.

VLSI Design and Embedded System Lab -2

Subject Code : 14EVE26
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:
 - a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. **Draw the Layout** and verify the DRC, ERC
 - c. Check for XX
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint***
2. Design the following circuits with given specifications*, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for XX
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier

ii) Common source and Common Drain amplifier.

3. Design an op-amp with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

a. Draw the schematic and verify the following

i) DC Analysis

ii). AC Analysis

iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for XX

d. Extract RC and back annotate the same and verify the Design.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library**.

a. Draw the schematic and verify the following

i) DC Analysis

ii) AC Analysis

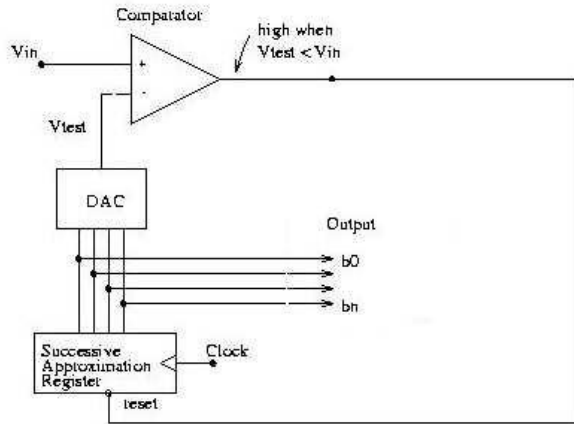
iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for XX

d. Extract RC and back annotate the same and verify the Design.

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.[Specifications to GDS-II]



* Appropriate specification should be given.

** Applicable Library should be added & information should be given to the Designer.

*** An appropriate constraint should be given

6 Design a simple 8-bit ADC converter using any one of the tools given above.

7. Design a simple NAND/NOR gate using any one of the tools given above.(Any other experiments may be added in supportive of the course)

EMBEDDED SYSTEMS

Embedded Programming Concepts (RTOS)

1. Create 'n' number of child threads. Each thread prints the message " I'm inthread number ..." and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux.

2. Implement the multithread application satisfying the following :

i. Two child threads are created with normal priority.

ii. Thread 1 receives and prints its priority and sleeps for 50ms and then quits.

iii. Thread 2 prints the priority of the thread 1 and rises its priority to above normal and retrieves the new priority of thread 1, prints it and then quits.

iv. The main thread waits for the child thread to complete its job and quits.

3. Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism.

4. Test the program below using multithread application

- i. The main thread creates a child thread with default stack size and name 'Child_Thread'.
- ii. The main thread sends user defined messages and the message 'WM_QUIT' randomly to the child thread.
- iii. The child thread processes the message posted by the main thread and quits when it receives the 'WM_QUIT' message.
- iv. The main thread checks the termination of the child thread and quits when the child thread completes its execution.
- v. The main thread continues sending the random messages to the child thread till the 'WM_QUIT' message is sent to child thread.
- vi. The messaging mechanism between the main thread and child thread is synchronous.

5. Test the program application for creating an anonymous pipe with 512 bytes of size and pass the 'Read Handle' of the pipe to a second process using memory mapped object. The first process writes a message 'Hi from Pipe Server'. The 2nd process reads the data written by the pipe server to the pipe and displays it on the console. Use event object for indicating the availability of data on the pipe and mutex objects for synchronizing the access in the pipe.

6. Create a POSIX based message queue for communicating between two tasks as per the requirements given below:-

- i. Use a named message queue with name 'MyQueue'.
- ii. Create two tasks (Task1 & Task2) with stack size 4000 & priorities 99 & 100 respectively.
- iii. Task 1 creates the specified message queue as Read Write and reads the message present, if any, from the message queue and prints it on the console.
- iv. Task 2 opens the message queue and posts the message 'Hi from Task2'. Handle all possible error scenarios appropriately.

Synthesis and Optimization of Digital Circuits

Subject Code : 14EVE41
No. of Lecture Hours /week: 04
Total no. of Lecture Hours : 50

IA Marks 50
Exam Hours 03
Exam Marks 100

Introduction: Microelectronics, semiconductor technologies and circuit taxonomy, Microelectronic design styles, computer aided synthesis and optimization.

Graphs: Notation, undirected graphs, directed graphs, combinatorial optimization, Algorithms, tractable and intractable problems, algorithms for linear and integer programs, graph optimization problems and algorithms, Boolean algebra and Applications.

Hardware Modeling: Hardware Modeling Languages, distinctive features, structural hardware language, Behavioural hardware language, HDLs used in synthesis, abstract models, structures logic networks, state diagrams, dataflow and sequencing graphs, compilation and optimization techniques.

Two Level Combinational Logic Optimization: Logic optimization, principles, operation on two level logic covers, algorithms for logic minimization, symbolic minimization and encoding property, minimization of Boolean relations.

Multiple Level Combinational Optimizations: Models and transformations for combinational networks, algebraic model, Synthesis of testable network, algorithm for delay evaluation and optimization, rule based system for logic optimization.

Sequential Circuit Optimization: Sequential circuit optimization using state based models, sequential circuit optimization using network models.

Schedule Algorithms: A model for scheduling problems, Scheduling wither source and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits.

Cell Library Binding: Problem formulation and analysis, algorithms for library binding, specific problems and algorithms for library binding (lookup table F.P.G.As and Anti fuse based F.P.G.As), rule based library binding.

Testing: Simulation, Types of simulators, basic components of a simulator, fault simulation Techniques, Automatic test pattern generation methods(ATPG), design for Testability (DFT) Techniques.

Reference Books:

1. Giovanni De Micheli, **“Synthesis and Optimization of Digital Circuits”**, Tata McGraw-Hill, 2003.
2. SrinivasDevadas, AbhijitGhosh, and Kurt Keutzer, **“Logic Synthesis”**, McGraw-Hill, USA, 1994.
3. NeilWeste and K. Eshragian, **“Principles of CMOS VLSI Design: A System Perspective”**, 2nd edition, Pearson Education (Asia) Pte. Ltd., 2000.
4. KevinSkahill, **“VHDL for Programmable Logic”**, Pearson Education(Asia) Pvt. Ltd., 2000

Advances in VLSI Design

Subject Code : 14EVE421
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS.

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS.

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nanotubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic. Defect tolerant computing,

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks -NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR- NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module layout.

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom design.

Reference Books:

1. Kevin F Brennan “**Introduction to Semi Conductor Device**”, Cambridge publications
2. Eugene D Fabricius “**Introduction to VLSI Design**”, McGraw-Hill International publications
3. D.APucknell “**Basic VLSI Design**”, PHI Publication

4. Wayne Wolf, “**Modern VLSI Design**” Pearson Education, SecondEdition , 2002

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.Tech. VLSI Design and Embedded Systems

I Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14ELD11	Advanced Mathematics	4	2	3	50	100	150	4
14EVE12	Digital VLSI Design	4	2	3	50	100	150	4
14EVE13	Advanced Embedded Systems	4	2	3	50	100	150	4
14EVE14	VLSI Process Technology	4	2	3	50	100	150	4
14EVE15X	Elective - 1	4	2	3	50	100	150	4
14EVE16	VLSI Design and Embedded System Lab -1	--	3	3	25	50	75	2
14EVE17	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective-1:

14 ELD151	Digital System Design using Verilog
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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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II Semester

CREDIT BASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14EVE21	Design of Analog and Mixed mode VLSI Circuits	4	2	3	50	100	150	4
14EVE22	Low Power VLSI Design	4	2	3	50	100	150	4
14EVE23	VLSI Testing and Verification	4	2	3	50	100	150	4
14ELD 24	Real Time Operating Systems	4	2	3	50	100	150	4
14EVE25X	Elective-2	4	2	3	50	100	150	4
14EVE26	VLSI Design and Embedded System Lab -2		3	3	25	50	75	2
14EVE27	Seminar on Advanced topics from refereed journals	--	3	--	25	--	25	1
**Project Phase-I(6 week Duration)								
Total		20	16	18	300	550	850	23

Elective-2:

14 EVE 255	SOC Design
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**** Between the II Semester and III Semester, after availing a vocation of 2 weeks.**

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III Semester: INTERNSHIP #

CREDIT BASED

Course Code	Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14EVE31	Midterm Presentation on Internship (After 8 weeks from the date of commencement) *	-	-	-	25	-	25	4
14EVE32	Report on Internship (After 16 weeks from the date of commencement)	-	-	-	75		75	12
14EVE33	Evaluation and Viva-voce	-	-	3	-	50	50	4
	Total	-	-	-	100	50	150	20

* The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

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M.TECH. VLSI Design and Embedded Systems

IV Semester

CREDIT BASED

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14EVE41	Synthesis and Optimization of Digital Circuits	4	2					
14EVE42X	Elective-3	4	2					
14EVE43	Evaluation of Project Phase-I	-	-	-	25	-	25	1
14EVE44	Phase-II : Midterm evaluation of Project #	-	-	-	25	-	25	1
14EVE45	Evaluation of Project Work and Viva-voce	-	-	3	-	100+100	200	18
Total		8	04	09	150	400	550	28
Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits								

Elective-3:

14 EVE 421	Advances in VLSI Design
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Note:

- 1) Project Phase – I: 6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carry out literature survey / visit to Industries to finalize the topic of dissertation.
- 2) Project Phase – II: 16 weeks duration during III Semester. Evaluation shall be taken during the Second week of the IV Semester. Total Marks shall be 25.
- 3) Project Evaluation: 24 weeks duration in IV Semester. Project Work Evaluation shall be taken up at the end of the IV Semester. Project Work Evaluation and Viva-Voce Examinations shall be conducted. Total Marks shall be 250 (Phase I Evaluation: 25 Marks, Phase –II Evaluation: 25 Marks, Project Evaluation marks by Internal Examiner (guide): 50, Project Evaluation marks by External Examiner: 50, marks for external and 100 for viva-voce).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase – I & II shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university. (Out of two external examiners at least one should be present).

Advanced Mathematics

Subject Code	: 14ELD11	IA Marks	: 50
No. of Lecture Hours / Week	: 04	Exam. Hours	: 03
Total No. of Lecture Hours	: 50	Exam. Marks	: 100

Matrix Theory

QR EL Decomposition – Eigen values using shifted QR algorithm- Singular Value EL Decomposition - Pseudo inverse- Least square approximations

Calculus of Variations

Concept of Functionals- Euler's equation – functional dependent on first and higher order derivatives – Functionals on several dependent variables – Isoperimetric problems- Variational problems with moving boundaries

Transform Methods

Laplace transform methods for one dimensional wave equation – Displacements in a string – Longitudinal vibration of a elastic bar – Fourier transform methods for one dimensional heat conduction problems in infinite and semi infinite rod.

Elliptic Equation

Laplace equation – Properties of harmonic functions – Fourier transform methods for laplace equations. Solution for Poisson equation by Fourier transforms method

Linear and Non Linear Programming

Simplex Algorithm- Two Phase and Big M techniques – Duality theory- Dual Simplex method. Non Linear Programming –Constrained extremal problems- Lagranges multiplier method- Kuhn- Tucker conditions and solutions

Reference Books:

1. Richard Bronson, "**Schaum's Outlines of Theory and Problems of Matrix Operations**", McGraw-Hill, 1988.

2. Venkataraman M K, "**Higher Engineering Mathematics**", National Pub. Co, 1992.
3. Elsgolts, L., "**Differential Equations and Calculus of Variations**", Mir, 1977.
4. Sneddon, I.N., "**Elements of Partial differential equations**", Dover Publications, 2006.
5. Sankara Rao, K., "**Introduction to partial differential equations**", Prentice – Hall of India, 1995
6. Taha H A, "**Operations research - An introduction**", McMillan Publishing co, 1982.

Digital VLSI Design

Subject Code : 14EVE12
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.

MOS Inverters: Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load, CMOS Inverter.

MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Dynamic Logic Circuits : Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).

Low-Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low-Power Design Through Voltage Scaling, Estimation and Optimization of Switching Activity, Reduction of Switched Capacitance, Adiabatic Logic Circuits.

BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.

Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.

Design for Manufacturability : Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modelling, Parametric Yield Estimation, Parametric Yield Maximization, Worst-Case Analysis, Performance Variability Minimization.

Reference Books:

1. Sung Mo Kang & Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, Third Edition.
2. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective”, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.

Advanced Embedded Systems

Subject Code : 14EVE13
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Typical Embedded System : Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components.

Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs.

Embedded Hardware Design and Development :EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation , PCB Layout Design – Building blocks, Component placement, PCB track routing.

ARM -32 bit Microcontroller family. Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture.

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages

Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of Files Generated on Cross compilation, Disassembler/ELDompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Reference Books:

1. Shibu K V, **“Introduction to Embedded Systems”**, Tata McGraw Hill Education Private Limited, 2009
2. Joseph Yiu, **“The Definitive Guide to the ARM Cortex-M3”**, Newnes, (Elsevier), 2008.
3. James K Peckol, **“Embedded Systems – A contemporary Design Tool”**, John Wiley, 2008.

VLSI Process Technology

Subject Code : 14EVE14
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Crystal Growth and Wafer Preparation: Introduction, Electronic-Grade Silicon, Czochralski Crystal Growing, Silicon Shaping, Process Considerations.

Epitaxy: Introduction, Vapour-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation.

Lithography: Introduction, Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography.

Reactive Plasma Etching: Introduction, Plasma Properties, Feature-Size Control and Anisotropic Etch Mechanisms, Other Properties of Etch Processes, Reactive Plasma-Etching Techniques and Equipment, Specific Etch Processes.

Dielectric and Polysilicon Film Deposition: Introduction, Deposition Processes, Polysilicon, Silicon Dioxide, Silicon Nitride, Plasma-Assisted Depositions, Other Materials.

Ion Implantation: Introduction, Range Theory, Implantation Equipment, Annealing, Shallow Junctions, High-Energy Implantation.

Metallization: Introduction, Metallization Applications, Metallization Choices, Physical Vapor Deposition, Patterning, Metallization Problems, New Role of Metallization.

VLSI Process Integration: Introduction, Fundamental Considerations for IC Processing, NMOS IC technology, CMOS IC Technology, MOS Memory IC Technology, Bipolar IC Technology, IC Fabrication.

Packaging of VLSI Devices: Introduction, Package Types, Packaging Design Considerations.

Reference Books:

1. S. M. Sze, "VLSI Technology", McGraw-Hill, Second Edition.
2. S.K. Ghandhi, "VLSI Fabrication Principles", John Wiley Inc., New York, 1994, Second Edition.

Digital System Design Using Verilog

Subject Code : 14 ELD151
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.

Combinational Basics: Boolean Functions and Boolean Algebra, Binary Coding, Combinational Components and Circuits, Verification of Combinational Circuits.

Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers.

Sequential Basics: Storage elements, Counters, Sequential Datapaths and Control, Clocked Synchronous Timing Methodology.

Memories: Concepts, Memory Types, Error Detection and Correction.

Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.

Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory.

I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.

Accelerators: Concepts, case study, Verification of accelerators.

Design Methodology: Design flow, Design optimization, Design for test.

REFERENCE BOOKS:

1. Peter J. Ashenden, “**Digital Design: An Embedded Ssystems Approach Using VERILOG**”, Elsevier, 2010.

VLSI Design and Embedded System Lab -1

Subject Code : 14EVE16
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 50
Exam Hours : 03
Exam Marks : 50

VLSI Digital Design

ASIC-Digital Design Flow

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library(**constraints to be given**). Do the initial timing verification with gate level simulation.

1. An inverter, Buffer and Transmission gate
2. Basic/universal gates
3. Flip flop -RS, D, JK, MS, T
4. Serial & Parallel adder
5. 4-bit counter [Synchronous & Asynchronous counter]

FPGA DIGITAL DESIGN

VLSI Front End Design programs:

Programming can be done using any compiler. Download the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels and logic analyzer)/Chipscope pro apart from verification by simulation with any of the front end tools

1. Write Verilog code for the design of 8-bit
 - i. Carry Ripple Adder
 - ii. Carry LookAhead adder
 - iii. Carry Skip Adder
 - iv. BCD Adder & Subtractor

2. Write Verilog Code for 8-bit
 - i. Array Multiplication (Signed and Unsigned)
 - ii. Booth Multiplication (Radix-4)
3. Write Verilog code for 4/8-bit
 - i. Magnitude Comparator
 - ii. LFSR
 - iii. Parity Generator
 - iv. Universal Shift Register
4. Write Verilog Code for 3-bit Arbitrary Counter to generate 0,1,2,3,6,5,7 and repeats.
5. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence.
Eg 11101 (with and without overlap) any sequence can be specified
6. Design a FIFO and LIFO buffers in Verilog and Verify its Operation.
7. Design a coin operated public Telephone unit using Mealy FSM model with following operations
 - i. The calling process is initiated by lifting the receiver.
 - ii. Insert 1 Rupee Coin to make a call.
 - iii. If line is busy, placing the receiver on hook should return a coin
 - iv. If line is through, the call is allowed for 60 seconds at the 45th second prompt another 1 Rupee coin to be inserted, to continue the call.
 - v. If user doesn't insert the coin within 60 seconds the call should be terminated.
 - vi. The system is ready to accept new call request when the receiver is placed on the hook.
 - vii. The FSM goes 'out of order' state when there is a Line Fault.

Note: Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits

Embedded Systems:

1. Use any EDA (Electronic Design Automation) tool to learn the Embedded Hardware Design and for PCB design.
2. Familiarize the different entities for the circuit diagram design.

3. Familiarize with the layout design tool, building blocks, component placement, routings, design rule checking etc.

ARM-CORTEX M3

[Programming to be done using Keiluvision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U].

1. Write an Assembly language program to calculate $10+9+8+ \dots +1$
2. Write a Assembly language program to link Multiple object files and link them together.
3. Write a Assembly language program to store data in RAM.
4. Write a C program to Output the "Hello World" message using UART.
5. Write a C program to Design a Stopwatch using interrupts.
6. Write an Exception vector table in C
7. Write an Assembly Language Program for locking a Mutex.
8. Write a SVC handler in C. Use the wrapper code to extract the correct stack frame starting location. The C handler can then use this to extract the stacked PC location and the stacked register values.

Design of Analog and Mixed Mode VLSI Circuits

Subject Code : 14 EVE21
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.

Single stage Amplifier: CS stage with resistance load, divide connected load, current source load, triode load, CS stage with source degeneration, source follower, common-gate stage, cascade stage, choice of device models.

Frequency response of CS stage: source follower, Common gate stage, Cascade stage and Difference pair. Noise in CS stage, C- G stage, source follower, cascade stage, differential pair.

Differential Amplifiers & Current Mirrors: Basic difference pair, common mode response, Differential pair with MOS loads, Gilbert cell. Basic current mirrors, Cascade mirrors, active current mirrors.

Operational Amplifiers: One Stage OP-Amp. Two Stage OP-Amp, Gain boosting, Common Mode Feedback, Slew rate, Power Supply Rejection, Noise in Op Amps.

Oscillators and Phase Locked Loops: Ring Oscillators, LC Oscillators, VCO, Mathematical Model of VCO. Simple PLL, Charge pump PLL, Non-ideal effects in PLL, Delay locked loops and applications.

Bandgap Refernces and Switched capacitor Circuits: General Considerations, Supply Independent biasing, PTAT Current Generation, Constant Gm Biasing, Sampling Switches, Switched Capacitor Amplifiers.

Data Converter Architectures: DAC & ADC Specifications, Resistor String DAC, R-2R Ladder Network, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

Reference Book:

1. “Design of Analog CMOS Integrated Circuits”, Behzad Razavi, TMH, 2007.

Low Power VLSI Design

Subject Code : 14 EVE22
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices.

Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Low Power Design Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library.

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

Reference Books:

1. Kaushik Roy, Sharat Prasad, “**Low-Power CMOS VLSI Circuit Design**” Wiley, 2000
2. Gary K. Yeap, “**Practical Low Power Digital VLSI Design**”, KAP, 2002

3. Rabaey, Pedram, "**Low Power Design Methodologies**" Kluwer Academic, 1997

VLSI Testing and Verification

Subject Code : 14 EVE23
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction to Testing: Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends Affecting Testing. Faults in Digital Circuits: Failures and Faults, Modeling of Faults, Temporary Faults.

Test Generation for Combinational Logic Circuits: Fault Diagnosis of Digital Circuits, Test Generation Techniques for Combinational Circuits, Detection of Multiple Faults in Combinational Logic Circuits.

Design of Testable Sequential Circuits: Controllability and Observability, Ad Hoc Design Rules for Improving Testability, Design of Diagnosable Sequential Circuits, The Scan-Path Technique for Testable Sequential Circuit Design, Level-Sensitive Scan Design, Random Access Scan Technique, Partial Scan, Testable Sequential Circuit Design Using Nonscan Techniques, CrossCheck, Boundary Scan.

Built-In Self Test: Test Pattern Generation for BIST, Output Response Analysis, Circular BIST, BIST Architectures.

Testable Memory Design: RAM Fault Models, Test Algorithms for RAMs, Detection of Pattern Sensitive Faults, BIST Techniques for Ram Chips, Test Generation and BIST for Embedded RAMs.

Importance of Design Verification: What is verification? What is attest bench? The importance of verification, Reconvergence model, Formal verification, Equivalence checking, Model checking, Functional verification.[Ref4- Chapter1]

Verification Tools: Linting tools: Limitations of linting tools, linting verilog source code, linting VHDL source code, linting OpenVera and e-source code, code reviews. Simulators: Stimulus and response, Event based simulation, cycle based simulation, Co-simulators, verification intellectual property: hardware modelers, waveform viewers.[Ref4-Chapter2]

The verification plan: The role of verification plan: specifying the verification plan, defining the first success. Levels of verification: unit level verification, reusable components verification, ASIC and FPGA verification, system level verification, board level verification, verifying strategies, verifying responses. [Ref4-Chapter3]

Static Timing Verification: Concept of static timing analysis. Cross talk and noise. Limitations of STA. slew of a wave form, Skew between the signals, Timing arcs and unateness, Min and Max timing paths, clock domains, operating conditions, critical path analysis, falsepaths, Timing models. [Ref5 Chapter 1, 2, 3, 8]

Physical Design Verification: Layout rule checks and electrical rule checks. Parasitic extraction. Antenna, Crosstalk and Noise: Cross talk glitch analysis, crosstalk delayanalysis, timing verification [Ref6 Chapter 8]

Reference Books:

1. P. K. Lala, “**Digital Circuit Testing and Testability**”, Academic Press
2. M.L. Bushnell and V.D. Agrawal, “**Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits**”, Kluwar Academic Publishers.
3. M. Abramovici, M.A. Breuer and A.D. Friedman, "**Digital Systems and Testable Design**", Jaico Publishing House, 2002.
4. JanickBergeron, “**Writing testbenches: functional verification of HDL models**”, 2nd edition ,Kluwer Academic Publishers,2003
5. JayaramBhasker,RakeshChadha ,“**Static Timing Analysis for Nanometer Designs**” A practical approach, Springer publications
6. PrakashRashinkar, PeterPaterson,Leena Singh “**System on a Chip Verification**”, Kulwer Publications.
7. <http://www.cse.psu.edu/~vijay/verify/instructors.html>

Real Time Operating Systems

Subject Code : 14 ELD24
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Introduction to Real-Time Embedded Systems: Brief history of Real Time Systems, A brief history of Embedded Systems.

System Resources: Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

Processing: Preemptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies.

I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.

Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.

Multi-resource Services: Blocking, Deadlock and livelock, Critical sections to protect shared resources, priority inversion

Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services.

Embedded System Components: Firmware components, RTOS system software mechanisms, Software application components.

Debugging Components: Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self test and diagnostics, External test equipment, Application-level debugging.

Performance Tuning: Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

High availability and Reliability Design: Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design.

Design of RTOS – PIC microcontroller. (Chap 13 of book Myke Predko)

Reference Books:

1. “**Real-Time Embedded Systems and Components**”, Sam Siewert, Cengage Learning India Edition, 2007.

2. “Programming and Customizing the PIC microcontroller”, Myke Predko, 3rd Ed, TMH, 2008.
3. “**Programming for Embedded Systems**”, Dreamtech Software Team, Jhon Wiley, India Pvt. Ltd., 2008.

SoC Design

Subject Code : 14EVE255
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Goal of the course – Today, VLSI chips are entire “system-on-chip” designs, which include processors, memories, peripheral controllers, and connectivity sub-systems. The course aims to provide an appreciation for the motivation behind SoC design, the challenges of SoC design, and the overall SoC design flow.

Motivation for SoC Design - Review of Moore’s law and CMOS scaling, benefits of system-on-chip integration in terms of cost, power, and performance. Comparison on System-on-Board, System-on-Chip, and System-in-Package. Typical goals in SoC design – cost reduction, power reduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap – IP based design and design reuse.

System On Chip Design Process: A canonical SoC Design, SoC Designflow, waterfall vs spiral, top down vs bottom up, Specification requirement, Types of Specification, System Design Process, System level design issues, Soft IP vs Hard IP, IP verification and Integration, Hardware-Software codesign, Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc.

Embedded Memories –cache memories, flash memories, embedded DRAM. Topics related to cache memories. Cache coherence. MESI protocol and Directory-based coherence.

Interconnect architectures for SoC. Bus architecture and its limitations. Network on Chip (NOC) topologies. Mesh-based NoC. Routing in an NoC. Packet switching and wormhole routing.

MPSoCs: What, Why, How MPSoCs, Techniques for designing MPSoCs, Performance and flexibility for MPSoCs design

Case Study: A Low Power Open Multimedia Application Platform for 3G Wireless.

Reference Books:

1. Sudeep Pasricha and Nikil Dutt, "**On-Chip Communication Architectures: System on Chip Interconnect**", Morgan Kaufmann Publishers © 2008.
2. Rao R. Tummala, Madhavan Swaminathan, "**Introduction to system on package sop- Miniaturization of the Entire System**", McGraw-Hill, 2008.
3. James K. Peckol, "**Embedded Systems: A Contemporary Design Tool**", Wiley Student Edition.
4. Michael Keating, Pierre Bricaud, "**Reuse Methodology Manual for System on Chip designs**", Kluwer Academic Publishers, 2nd edition, 2008.
5. Sung-Mo Kang, Yusuf Leblebici, "**CMOS Digital Integrated Circuits**", Tata Mcgraw-Hill, 3rd Edition.

VLSI Design and Embedded System Lab -2

Subject Code : 14EVE26
No. of Lecture Hours /week : 03
Total no. of Lecture Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:
 - a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. **Draw the Layout** and verify the DRC, ERC
 - c. Check for XX
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint***
2. Design the following circuits with given specifications*, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for XX
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier

ii) Common source and Common Drain amplifier.

3. Design an op-amp with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

a. Draw the schematic and verify the following

i) DC Analysis

ii). AC Analysis

iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for XX

d. Extract RC and back annotate the same and verify the Design.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library**.

a. Draw the schematic and verify the following

i) DC Analysis

ii) AC Analysis

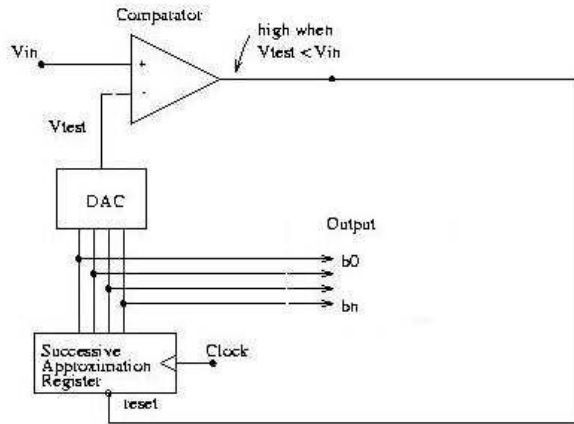
iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for XX

d. Extract RC and back annotate the same and verify the Design.

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.[Specifications to GDS-II]



* Appropriate specification should be given.

** Applicable Library should be added & information should be given to the Designer.

*** An appropriate constraint should be given

6 Design a simple 8-bit ADC converter using any one of the tools given above.

7. Design a simple NAND/NOR gate using any one of the tools given above.(Any other experiments may be added in supportive of the course)

EMBEDDED SYSTEMS

Embedded Programming Concepts (RTOS)

1. Create 'n' number of child threads. Each thread prints the message " I'm inthread number ... " and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux.

2. Implement the multithread application satisfying the following :

i. Two child threads are created with normal priority.

ii. Thread 1 receives and prints its priority and sleeps for 50ms and then quits.

iii. Thread 2 prints the priority of the thread 1 and rises its priority to above normal and retrieves the new priority of thread 1, prints it and then quits.

iv. The main thread waits for the child thread to complete its job and quits.

3. Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism.

4. Test the program below using multithread application

- i. The main thread creates a child thread with default stack size and name 'Child_Thread'.
- ii. The main thread sends user defined messages and the message 'WM_QUIT' randomly to the child thread.
- iii. The child thread processes the message posted by the main thread and quits when it receives the 'WM_QUIT' message.
- iv. The main thread checks the termination of the child thread and quits when the child thread completes its execution.
- v. The main thread continues sending the random messages to the child thread till the 'WM_QUIT' message is sent to child thread.
- vi. The messaging mechanism between the main thread and child thread is synchronous.

5. Test the program application for creating an anonymous pipe with 512 bytes of size and pass the 'Read Handle' of the pipe to a second process using memory mapped object. The first process writes a message 'Hi from Pipe Server'. The 2nd process reads the data written by the pipe server to the pipe and displays it on the console. Use event object for indicating the availability of data on the pipe and mutex objects for synchronizing the access in the pipe.

6. Create a POSIX based message queue for communicating between two tasks as per the requirements given below:-

- i. Use a named message queue with name 'MyQueue'.
- ii. Create two tasks (Task1 & Task2) with stack size 4000 & priorities 99 & 100 respectively.
- iii. Task 1 creates the specified message queue as Read Write and reads the message present, if any, from the message queue and prints it on the console.
- iv. Task2 opens the message queue and posts the message 'Hi from Task2'. Handle all possible error scenarios appropriately.

Synthesis and Optimization of Digital Circuits

Subject Code : 14EVE41
No. of Lecture Hours /week: 04
Total no. of Lecture Hours : 50

IA Marks 50
Exam Hours 03
Exam Marks 100

Introduction: Microelectronics, semiconductor technologies and circuit taxonomy, Microelectronic design styles, computer aided synthesis and optimization.

Graphs: Notation, undirected graphs, directed graphs, combinatorial optimization, Algorithms, tractable and intractable problems, algorithms for linear and integer programs, graph optimization problems and algorithms, Boolean algebra and Applications.

Hardware Modeling: Hardware Modeling Languages, distinctive features, structural hardware language, Behavioural hardware language, HDLs used in synthesis, abstract models, structures logic networks, state diagrams, dataflow and sequencing graphs, compilation and optimization techniques.

Two Level Combinational Logic Optimization: Logic optimization, principles, operation on two level logic covers, algorithms for logic minimization, symbolic minimization and encoding property, minimization of Boolean relations.

Multiple Level Combinational Optimizations: Models and transformations for combinational networks, algebraic model, Synthesis of testable network, algorithm for delay evaluation and optimization, rule based system for logic optimization.

Sequential Circuit Optimization: Sequential circuit optimization using state based models, sequential circuit optimization using network models.

Schedule Algorithms: A model for scheduling problems, Scheduling wither source and without resource constraints, Scheduling algorithms for extended sequencing models, Scheduling Pipe lined circuits.

Cell Library Binding: Problem formulation and analysis, algorithms for library binding, specific problems and algorithms for library binding (lookup table F.P.G.As and Anti fuse based F.P.G.As), rule based library binding.

Testing: Simulation, Types of simulators, basic components of a simulator, fault simulation Techniques, Automatic test pattern generation methods(ATPG), design for Testability (DFT) Techniques.

Reference Books:

1. Giovanni De Micheli, “**Synthesis and Optimization of Digital Circuits**”, Tata McGraw-Hill, 2003.
2. SrinivasDevadas, AbhijitGhosh, and Kurt Keutzer, “**Logic Synthesis**”, McGraw-Hill, USA, 1994.
3. NeilWeste and K. Eshragian, “**Principles of CMOS VLSI Design: A System Perspective**”, 2nd edition, Pearson Education (Asia) Pte. Ltd., 2000.
4. KevinSkahill, “**VHDL for Programmable Logic**”, Pearson Education(Asia) Pvt. Ltd., 2000

Advances in VLSI Design

Subject Code : 14EVE421
No. of Lecture Hours /week : 04
Total no. of Lecture Hours : 50

IA Marks : 50
Exam Hours : 03
Exam Marks : 100

Review of MOS Circuits: MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS.

MESFETS: MESFET and MODFET operations, quantitative description of MESFETS.

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nanotubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic. Defect tolerant computing,

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks -NMOS and CMOS functional blocks.

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR- NOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module layout.

System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom design.

Reference Books:

1. Kevin F Brennan “**Introduction to Semi Conductor Device**”, Cambridge publications
2. Eugene D Fabricius “**Introduction to VLSI Design**”, McGraw-Hill International publications
3. D.APucknell “**Basic VLSI Design**”, PHI Publication

4. Wayne Wolf, "**Modern VLSI Design**" Pearson Education, SecondEdition , 2002

**SCHEME OF TEACHING AND EXAMINATION
M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS**

I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16ELD11	Advanced Engineering Mathematics	4	-	3	20	80	100	4
2	16EVE12	Digital VLSI Design	4	-	3	20	80	100	4
3	16EVE13	Advanced Embedded System	4	-	3	20	80	100	4
4	16EVE14	Low Power VLSI Design	4	-	3	20	80	100	4
5	16EXX15X	Elective-1	3	-	3	20	80	100	3
6	16EVEL16	VLSI and ES Lab -1		3	3	20	80	100	2
7	16EVE17	Seminar on advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective -1	
16 EVE151	Digital System Design Using Verilog

M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS

II SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16EVE21	Design of Analog and Mixed mode VLSI Circuits	4	-	3	20	80	100	4
2	16EVE22	VLSI Testing	4	-	3	20	80	100	4
3	16EVE23	Advances in VLSI Design	4	-	3	20	80	100	4
4	16EVE24	Real Time Operating System	4	-	3	20	80	100	4
5	16EXX25X	Elective -2	3	-	3	20	80	100	3
6	16EVEL26	VLSI and ES Lab -2		3	3	20	80	100	2
7	16EVE27	Seminar on Advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective -2	
16EVE254	SoC Design

M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS

III SEMESTER: Internship

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16EVE31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16EVE32	Report on Internship	-	-	-	25	-	25	
3	16EVE33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16EVE34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

M.Tech. in VLSI DESIGN AND EMBEDDED SYSTEMS

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16ELD41	Synthesis and Optimization of Digital Circuits	4	-	3	20	80	100	4
2	16EXX42X	Elective-3	3	-	3	20	80	100	3
3	16EVE43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16EVE44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			-	-	6	90	360	450	20

Elective -3	
16ECS422	Advances in Image Processing

Note:

1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted.

a. Internal Examiner shall carry out the evaluation for 100 marks.

b. External Examiner shall carry out the evaluation for 100 marks.

c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.

d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.Tech-VLSI & ES-2016-FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	16ELD11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Acquaint with principles of linear algebra, calculus of variations, probability theory and random process.
- Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences.

Modules	Revised Bloom's Taxonomy (RBT) Level
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Module -1

Linear Algebra-I

Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank-Nullity theorem(without proof). Matrix form of linear transformations-Illustrative examples.(**Text 1 & Ref. 1**)

L1,L2

Module -2

Linear Algebra-II

Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations.(**Text 1 & Ref. 1**)

L1,L2

Module -3

Calculus of Variations

Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.(**Text 2 & Ref. 2**)

L1,L2

Module -4

<p>Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions-examples.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Module -5</p>	
<p>Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Statement of central limit theorem-Illustrative examples. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images. • Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems. • Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits. • Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications. • Apply the idea of joint probability distributions and the role of parameter-dependent random variables in random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, —Advanced Engineering Mathematics II , 10th edition, Wiley, 2015.
3. Scott L.Miller, Donald G. Childers: —Probability and Random Process with application to Signal Processing II , Elsevier Academic Press, 2nd Edition,2013.

Reference books:

1. Richard Bronson: —Schaum's Outlines of Theory and Problems of Matrix Operations II , McGraw-Hill, 1988.
2. Elsgolts, L.: II Differential Equations and Calculus of Variations II , MIR Publications, 3rd Edition, 1977.
3. T.Veerarajan: —Probability, Statistics and Random Process—, 3rd Edition, Tata McGraw Hill Co.,2008.

Web links:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>
4. www.wolfram.com

DIGITAL VLSI DESIGN[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –I

Subject Code	16EVE12	IA Marks	20
Number	04	Exam Marks	80
Total Number of	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Explain VLSI Design Methodologies
- Learn Static and Dynamic operation principles, analysis and design of inverter circuit.
- Infer state of the art Semiconductors Memory circuits.
- Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits.
- Illustrate VLSI and ASIC design.

Modules	Revised Bloom's Taxonomy (RBT) Level
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Module -1

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.

MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.

L1, L2**Module -2**

MOS Inverters-Static Characteristics: CMOS Inverter.

MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

L2, L3**Module -3**

<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>	<p>L1, L2, L3</p>
<p>Module -4</p>	
<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Sung Mo Kang & Yosuf Leblebici, –CMOS Digital Integrated Circuits: Analysis and Designll , Tata McGraw-Hill, Third Edition.</p>	

Reference Books:

1. Neil Weste and K. Eshragian, —Principles of CMOS VLSI Design: A System Perspective, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.
2. Wayne, Wolf, —Modern VLSI Design: System on Silicon, Prentice Hall PTR/Pearson Education, Second Edition, 1998.
3. Douglas A Pucknell & Kamran Eshragian, —Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).

ADVANCED EMBEDDED SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EVE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Describe the hardware software co-design and firmware design approaches
- Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.
- Program ARM CORTEX M3 using the various instructions, for different applications.

Modules**Revised Bloom's Taxonomy (RBT) Level****Module -1**

Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).

L1, L2, L3**Module -2**

Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).

L1, L2, L3

Module -3	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)	L1, L2, L3
Module -4	
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6)	L1, L2, L3
Module -5	
Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. ● Explain the hardware software co-design and firmware design approaches. ● Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. ● Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, –The Definitive Guide to the ARM Cortex-M3, 2ndedn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

LOW POWER VLSI DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER -I

Subject Code	16EVE14	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Know the basics and advanced techniques in low power design which is a hot topic in today's market where the power plays a major role.
- Describe the various power reduction and the power estimation methods.
- Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system
- Apply State-of-the art approaches to power estimation and reduction.
- Practice the low power techniques using current generation design style and process technology

Modules

**Revised
Bloom's
Taxonom**

Module -1

Introduction: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS leakage current, static current, basic principles of low power design, low power figure of merits.

Simulation power analysis: SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. (Text 1)

L1, L2

Module -2

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Circuit: Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage. (Text 1)

L1, L2, L3

Module -3

Logic: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic (Text 1).

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network (Text 2).

L1, L2, L3

Module -4

<p>Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation (Text 1).</p> <p>Low power arithmetic components: Introduction, circuit design style, adders, multipliers, division (Text 2).</p>	L1- L4
Module -5	
<p>Low power memory design: Introduction, sources and reductions of power dissipation in memory subsystem, sources of power dissipation in DRAM and SRAM (Text 2).</p> <p>Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis (Text 2).</p> <p>Advanced Techniques: Adiabatic computation, pass transistor, Asynchronous circuits (Text 1).</p>	L1-L4
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Identify the sources of power dissipation in CMOS circuits. • Perform power analysis using simulation based approaches and probabilistic analysis. • Use optimization and trade-off techniques that involve power dissipation of digital circuits. • Make the power design a reality by making power dimension an integral part of the design process • Use practical low power design techniques and their analysis at various levels of design abstraction and analyse how these are being captured in the latest design automation environments. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic, 1998. 2. Jan M.Rabaey, Massoud Pedram, “Low Power Design Methodologies”, Kluwer Academic, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000 2. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, “ Low power VLSI CMOS circuit design”, Kluwer Academic,1995. 	

DIGITAL SYSTEM DESIGN USING VERILOG

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EVE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03

CREDITS – 03**Course objectives:** This course will enable students to:

- Understand the concepts of Verilog Language
- Design the digital systems as an activity in a larger systems design context.
- Study the design and operation of semiconductor memories frequently used in application specific digital system.
- Inspect how effectively IC's are embedded in package and assembled in PCB's for different application
- Design and diagnosis of processors and I/O controllers they can be used in embedded systems

Modules**Revised Bloom's Taxonomy (RBT)****Module -1****Introduction and Methodology:** Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.**L1, L2****Module -2****Number Basics:** Unsigned and Signed Integers, Fixed and Floating-point Numbers.**Sequential Basics:** Storage elements, Counters, Sequential Data paths and Control, Clocked Synchronous Timing Methodology.**L1, L2****Module -3****Memories:** Concepts, Memory Types, Error Detection and Correction.
Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.**L1, L2****Module -4****Processor Basics:** Embedded Computer Organization, Instruction and Data, Interfacing with memory.**I/O interfacing:** I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.**L2, L3****Module -5**

<p>Accelerators: Concepts, case study, Verification of accelerators. Design Methodology: Design flow, Design optimization, Design for test.</p>	<p>L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Design embedded systems, using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores. • Design the combinational circuits using discrete gates and programmable logic devices. • Describe Verilog model for sequential circuits and test pattern generation • Explore the different types of semiconductor memories and their usage for specific chip design • Synthesis different types of processor and I/O controllers that are used in embedded system design 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Peter J. Ashenden, –Digital Design: An Embedded Systems Approach Using VERILOG^{II} , Elsevier, 2010.</p>	
<p>Reference Book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Samir Palnitkar.</p>	

VLSI and ES LAB - 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory Code	16EVEL16	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Learn Verilog Code Programming for the design of digital circuits
- Use FPGA/CPLD board and Logic Analyzer or Chipscope to verify the results
- Learn Assembly language programming for different applications using ARM-Cortex M3 Kit and Keil uVision- 4 tool.
- Learn C language programming for different applications using ARM- Cortex M3 Kit and Keil uVision-4 tool.

Laboratory Experiments:

**Revised
Bloom's
Taxonomy**

- 1) **Digital Design Experiments:** Using Verilog code and any Compiler. Download code to FPGA/CPLD board and verify the output using Logic Analyzer or Chipscope
- a) Design and verify an 8 to 3 programmable priority encoder
 - b) Design and verify 3-bit Arbitrary Counter and repeat the given sequence
 - c) Design and Verify BCD adder and subtractor
 - d) Design and verify a sequential block to generate a sequence (say 11101) using appropriate FSM.
 - e) Design and verify 8 bit Ripple carry adder and Carry skip adder.
 - f) Design and verify a Linear feedback shift register based on a given polynomial expression
 - g) Design and verify the following 8 bit multipliers. Also report on area delay trade-off
 - i) Serial Multiplier
 - ii) Parallel Multiplier
 - h) Design and verify a parameterized FIFO
 - i) Design and verify register file which has 32-entry 3-ports having explicit address decoder. The ports are dedicated for read and write and will take one clock cycle for read or write operation

L2,L3,L4

<p>2) ARM Cortex M3 Programs: (Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U)</p> <ol style="list-style-type: none"> a) Write an Assembly language program to calculate the sum and display the result for the addition of first ten numbers. SUM = 10+9+8+. +1 b) Write a Assembly language program to link multiple object files and link them together c) Write an Assembly language program to store data in RAM d) Write a C program to Output the –Hello World message using UART e) Write a C program to Design a Stopwatch using interrupts 	<p>L2,L3,L4</p>
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Course outcomes: On the completion of this laboratory course, the students will be able to:

- Develop Verilog Code for the design of digital circuits
- Use FPGA/CPLD board and Logic Analyzer or Chipscope to verify the results
- Develop Assembly language programs for different applications using ARM-Cortex M3 Kit and Keil uVision-4 tool.
- Develop C language programs for different applications using ARM-Cortex M3 Kit and Keil uVision-4 tool

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, two questions using different tool to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

M.Tech-VLSI & ES-2016-SECOND SEMESTER SYLLABUS

Design of Analog and Mixed Mode VLSI Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – II]			
Subject Code	16EVE21	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Describe basic physics and operation of MOS devices. ● Exemplify single-stage and differential amplifiers and current mirrors ● Describe operational amplifiers ● Learn the design of phase-locked-loops ● Know the role of Data converters in an ever-increasing digital world. 			
Modules			RBT Level
Module 1			
Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.			L1, L2
Single stage Amplifier: Basic Concepts, Common Source stage.(Text 1)			
Module 2			
Single stage Amplifier: Source follower, common-gate stage, Cascode Stage, choice of device models.			L1,L2
Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common mode response, Differential pair with MOS loads, Gilbert cell. (Text 1)			
Module 3			
Passive and Active Current Mirrors: Basic current mirrors, Cascode Current mirrors, Active Current mirrors.			L1,L2,L3
Operational Amplifiers (part-1): General Considerations, One Stage OP-Amp, Two Stage OP-Amp, Gain boosting. (Text 1)			
Module 4			
Operational Amplifiers (part-2): Common Mode Feedback, Slew rate, Power Supply Rejection.			L1,L2,L3
Phase Locked Loops: Simple PLL, Charge pump PLLs, Non-ideal effects in PLLs, Delay-Locked Loops, Applications. (Text 1)			
Module 5			
Data Converter Architectures: DAC & ADC Specifications, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. (Text 2)			L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

- Use efficient analytical tools for quantifying the behaviour of basic circuits by inspection.
- Design high-performance, stable operational amplifiers with the trade-offs between speed, precision and power dissipation.
- Design and study the behaviour of phase-locked-loops for the applications.
- Identify the critical parameters that affect the analog and mixed-signal VLSI circuits' performance
- Perform calculations in the digital or discrete time domain, more sophisticated data converters to translate the digital data to and from inherently analog world.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Behzad Razavi, –Design of Analog CMOS Integrated Circuits|| , TMH, 2007.
2. R. Jacob Baker, –CMOS Circuit Design, Layout, and Simulation|| , Second Edition, Wiley.

Reference Book:

Phillip E. Allen, Douglas R. Holberg, –CMOS Analog Circuit Design|| , Second Edition, Oxford University Press.

VLSI Testing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE22	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn various types of faults and fault modeling • Comprehend the need for testing and testable design of digital circuits • Illustrate methods and algorithms for testing digital combinatorial networks and test pattern generation • Exemplify methods for testing sequential circuits and memory testing • Inferring testing methods using Boundary scan, Built-in self test and other advanced topics in digital circuit design. 			
Modules			RBT Level
Module 1			
<p>Faults in digital circuits: Failures and Faults, Modeling of faults, Temporary Faults. (Text 1)</p> <p>Logic Simulation: Applications, Problems in simulation based design verification, types of simulation, The unknown logic values, compiled simulation, event-driven simulation, Delay models, Element evaluation, Hazard detection, Gate-level event-driven Simulation. (Text 2)</p>			L1,L2
Module 2			
<p>Test generation for Combinational Logic circuits: Fault Diagnosis of digital circuits, Test generation techniques for combinational circuits, Detection of multiple faults in Combinational logic circuits. (Text 1)</p> <p>Testable Combinational logic circuit design: The Read-Muller expansion technique, Three level OR-AND-OR design, Automatic synthesis of testable logic.(Text 1)</p>			L1,L2,L3
Module 3			
<p>Testable Combinational logic circuit design: Testable design of multilevel combinational circuits, Synthesis of random pattern testable combinational circuits, Path delay fault testable combinational logic design, Testable PLA design. (Text 1)</p> <p>Test generation for Sequential circuits: Testing of sequential circuits as Iterative combinational circuits, state table verification, Test generation based on Circuit Structure, Functional Fault models, test Generation based on Functional Fault models. (Text 1)</p>			L1,L2,L3
Module 4			
<p>Design of testable sequential circuits: Controllability and observability, Ad-Hoc design rules for improving testability, design of</p>			L1,L2,L3

<p>diagnosable sequential circuits, the scan-path technique for testable sequential circuit design, Level Sensitive Scan Design(LSSD), Random Access Scan Technique, Partial scan, testable sequential circuit design using Nonscan Techniques, Cross check, Boundary Scan. (Text 1)</p>	
<p>Module 5</p>	
<p>Built-In Self Test: Test pattern generation for BIST, Output response analysis, Circular BIST, BIST Architectures. (Text 1)</p>	<p>L1,L2,L3</p>
<p>Testable Memory Design: RAM Fault Models, Test algorithms for RAMs, Detection of pattern-sensitive faults, BIST techniques for RAM chips, Test generation and BIST for embedded RAMs. (Text1)</p>	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Analyze the need for fault modeling and testing of digital circuits • Generate fault lists for digital circuits and compress the tests for efficiency • Create tests for digital memories and analyze failures in them • Apply boundary scan technique to validate the performance of digital circuits • Design built-in self tests for complex digital circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Lala Parag K., Digital Circuit Testing and Testability, New York, Academic Press, 1997. 2. Abramovici M, Breuer M A and Friedman A D, –Digital Systems Testing and Testable Designll , Wiley, 1994. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Vishwani D Agarwal, –Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuitsll , Springer, 2002. 2. Wang, Wu and Wen, –VLSI Test Principles and Architecturesll , Morgan Kaufmann, 2006. 	

Advances in VLSI Design [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Learn circuit-oriented approach towards digital design • Illustrate the impact of interconnect wiring on the functionality and performance of a digital gate. • Infer different approaches to digital timing and clocking circuits • Understand the impact of clock skew on the behaviour of digital synchronous circuits • Explain the role of peripheral circuitry such as the decoders, sense amplifiers, drivers and control circuitry in the design of reliable and fast memories 			
Modules			RBT Level
Module 1			
Implementation Strategies For Digital ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective-The Implementation Platform of the Future.			L1,L2,L3
Module 2			
Coping With Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability-Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability-Ohmic Voltage Drop, Electromigration, Resistance and Performance-RC Delay, Inductive Parasitics, Inductance and Reliability-Voltage Drop, Inductance and Performance-Transmission Line Effects, Advanced Interconnect Techniques, Reduced-Swing Circuits, Current-Mode Transmission Techniques, Perspective: Networks-on-a-Chip.			L1,L2,L3
Module 3			
Timing Issues In Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Based Clocking, Self-Timed Circuit Design, Self-Timed Logic - An Asynchronous			L1,L2,L3

Technique, Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters, Synchronizers-Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL.	
Module 4	
Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control.	L1,L2,L3
Module 5	
Designing Memory and Array Structures: Memory Reliability and Yield, Signal-to-Noise Ratio, Memory yield, Power Dissipation in Memories, Sources of Power Dissipation in Memories, Partitioning of the memory, Addressing the Active Power Dissipation, Data-retention dissipation, Case Studies in Memory Design: The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory, Perspective: Semiconductor Memory Trends and Evolutions.	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Apply design automation for complex circuits using the different implementation methodology like custom versus semi-custom, hardwired versus fixed, regular array versus ad-hoc. • Use the approaches to minimize the impact of interconnect parasitics on performance, power dissipation and circuit reliability • Impose the ordering of the switching events to meet the desired timing constraints using synchronous, clocked approach. • Infer the reliability of the memory 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Jan M Rabey, Anantha Chandrakasan, Borivoje Nikolic, –Digital Integrated Circuits-A Design Perspectivell , PHI, 2nd Edition.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. M. Smith, –Application Specific Integrated circuitsll , Addison Wesley, 1997 2. H. Veendrick, –MOS IC’s: From Basics to ASICs, Wiley-VCH, 1992. 3. Anantha P. Chandrakasan , Robert W. Brodersen, –Low Power Digital CMOS Designll , Kluwer Academic Publisher, 1995. 	

Real Time Operating System [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging			L1,L2,L3

<p>Components, Exceptions, assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace Ports, External test equipment. (Text 1: Selected topics from Chap. 8,9)</p>	
<p>Module 5</p>	
<p>Process and Threads: Process and thread creations, Simple Programs, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication using multiple threads. (Text 2: Chap. 11)</p>	<p>L1,L2,L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. • Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC to improve the system performance. • Apply priority based static and dynamic real time scheduling techniques for the given specifications. • Analyze deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. • Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, –Real-Time Embedded Systems and Componentsll , Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, Dream Tech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, –Real Time Systemll , Pearson education, 2008. 2. Dream Tech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008. 	

SoC Design			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE254	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Describe the ARM processor architecture and user-level assembly language programming • Appreciate what a high-level language (in this case, C) really needs and how those needs are met by the ARM instruction set. • raises the issues involved in debugging systems which use embedded processor cores and in the production testing of board-level systems. • Learn the concept of memory hierarchy, discussing the principles of memory management and caches. 			
Modules			RBT Level
Module 1			
<p>ARM Organization and Implementation: 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.</p> <p>The ARM Instruction Set : Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instruction, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions, Coprocessor instructions, Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture v5T only), Unused instruction space, Memory faults, ARM architecture variants.</p>			L1,L2
Module 2			
<p>Architectural Support for High-Level Languages: Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, Use of memory, Run-time environment.</p> <p>Architectural Support for System Development: The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA), The ARM reference peripheral specification, Hardware system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, Embedded Trace,</p>			L1,L2

Signal processing support.	
Module 3	
ARM Processor Cores: ARM7TDMI, ARM8,ARM9TDMI, ARM10TDMI ,Discussion ,Example and exercises. Memory Hierarchy: Memory size and speed, On-chip memory, Caches, Cache design - an example, Memory management, Examples and exercises.	L1,L2
Module 4	
Architectural Support for Operating Systems: An introduction to operating systems, The ARM system control coprocessor, CP15 protection unit registers, ARM protection unit,CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/ Output, Example and exercises. ARM CPU Cores: The ARM710T, ARM720T and ARM740T, The ARM810,The Strong ARM SA-110,The ARM920T and ARM940T,The ARM946E-S and ARM966E-S,The ARM1020E,Discussion,Example and exercises.	L1,L2
Module 5	
Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The One C™ VWS22100 GSM chip, The Ericsson-VLSI Bluetooth Baseband Controller, The ARM7500 and ARM7500FE, The ARM7100 364,The SA-1100 368,Examples and exercises. The AMULET Asynchronous ARM Processors: Self-timed design 375,AMULET1 377,AMULET2 381,AMULET2e 384,AMULET3 387,The DRACO telecommunications controller 390, A self-timed future? 396,Example and exercises.	L1,L2,L3
Course Outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Apply the 3- and 5-stage pipeline ARM processor cores and analyse the implementation issues. • Use the concepts and methodologies employed in designing a System-on-chip (SoC) based around a microprocessor core and in designing the microprocessor core itself. • Understand how SoCs and microprocessors are designed and used, and why a modern processor is designed the way that it is. • Use integrated ARM CPU cores (including StrongARM) that incorporate full support for memory management. • Analyze the requirements of a modern operating system and use the ARM architecture to address the same. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Steve Furber, –ARM System-On-Chip Architecture, Addison Wesley, 2nd edition.	

References Books:

1. Joseph Yiu, —The Definitive Guide to the ARM Cortex-M3ll , 2nd edn, Newnes, (Elsevier), 2010.
2. Sudeep Pasricha and Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnectll , Morgan Kaufmann, Publishers © 2008.
3. Michael Keating, Pierre Bricaud, —Reuse Methodology Manual for System on Chip designsl , Kluwer Accademic Publishers, 2nd edition, 2008.

VLSI and ES Lab-2			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – II			
Laboratory Code	16EVEL26	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This laboratory course enables students to:</p> <ul style="list-style-type: none"> • Learn the CAD tool and the flow of the Full Custom IC design cycle. • Learn running DRC, LVS and Parasitic Extraction of the various designs. • Create various components like inverter, differential amplifier and use the same in the design of operational amplifier, R-2R based DAC and ADC. • Understand the suitability of different techniques of IPC and task switching in a multithreaded application. • Study and implement different types of data structures required to implement inter task communication. • Implement Inter task communication using an appropriate data structure. 			
Part – A: Experiments to be done using CADENCE/SYNOPSIS/MENTOR GRAPHICS/TANNER Tool			RBT Level
<p>1. Design an Inverter with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) Transient Analysis b. Draw the Layout and verify the DRC, ERC c. Check for XX d. Extract RC and back annotate the same and verify the Design e. Verify & Optimize for Time, Power and Area to the given constraint*** <p>(Following specification may be used to design an Inverter in gpdk 180nm technology with minimum area:</p> <ol style="list-style-type: none"> i. Maximum output rise time=100ps ii. Maximum output fall time=100ps iii. $P_{avg} \leq 15\mu w$ iv. Load capacitance= 50fF v. Input rise time=200ps vi. Input fall time=200ps <p>Choose maximum frequency based on the power)</p>			L3
<p>Design the following circuits with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) AC Analysis iii) Transient Analysis 			L3

<ul style="list-style-type: none"> b. Draw the Layout and verify the DRC, ERC, LVS c. Check for XX d. Extract RC and back annotate the same and verify the Design. <ul style="list-style-type: none"> 2. i) A Single Stage differential amplifier ii) Common source amplifier <ul style="list-style-type: none"> 3. Design an op-amp with given specification* using given differential amplifier Common source amplifier in library** 4. Design a 4 bit R-2R based DAC for the given specification** 	
<ul style="list-style-type: none"> 5. Design an Integrator and Differentiator using OPAMP (First Order) 	
<ul style="list-style-type: none"> 6. Design and characterize a basic Sigma delta ADC from the available designs. 	
<ul style="list-style-type: none"> 7. Design a simple NAND/NOR gate using any one of the tools given above. <p>(Any other experiments may be added in supportive of the course)</p> <p>* Appropriate specification should be given.</p> <p>** Applicable Library should be added & information should be given to the Designer.</p> <p>*** An appropriate constraint should be given</p>	
Part – B: Experiments to be done using Linux	
<ul style="list-style-type: none"> 1. Develop and test programs to (a) create child process and display it's id and (b) Execute child process function using switch structure 	
<ul style="list-style-type: none"> 2. Develop and test program for a multithreaded application, where communication is through a buffer for the conversion of lowercase text to uppercase text, using semaphore concept. 	
<ul style="list-style-type: none"> 3. Develop and test program for a multithreaded application, where communication is through shared memory for the conversion of lowercase text to uppercase text. 	
<ul style="list-style-type: none"> 4. Develop program for inter-thread communication using message queue. Data is to be input from the keyboard for the chosen application. 	
<ul style="list-style-type: none"> 5. Create '_n' number of child threads. Each thread prints the message –I'm in thread number ... and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux. 	
<ul style="list-style-type: none"> 6. Implement the multi-thread application satisfying the following : <ul style="list-style-type: none"> i. Two child threads are created with normal priority. ii. Thread 1 receives and prints its priority and sleeps for 50ms and then quits. iii. Thread 2 prints the priority of the thread 1 and rises its priority to above normal and retrieves the new priority of thread 1, prints it and then quits. iv. The main thread waits for the child thread to complete its job and 	L3

quits.	
7. Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism	
<p>Course outcomes: This laboratory course enable the students to:</p> <ul style="list-style-type: none"> • Design Analog, digital and mixed mode circuits • Learn the various issues in Mixed signal designs basically data converters. • Acquire hands-on skills of using CAD tools in VLSI design. • Appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system. • Select a suitable task switching technique in a multithreaded application. • Implement different techniques of message passing and Inter task communication. • Implement different data structures such as pipes, queues and buffers in multithreaded programming. 	
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one experiment from Part-A and One experiment from Part-B is to be set. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the Procedure part to be made zero. 	
<p>Reference Book: (for some of the Part-B programs) Dreamtech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008.</p>	

M.Tech-VLSI & ES-2016-FOURTH SEMESTER SYLLABUS

Synthesis and Optimization of Digital Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ELD41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students:</p> <ul style="list-style-type: none"> • Understand the need for optimization and dimensions of optimization for digital circuits. • Understand basic optimization techniques used in circuits design • Understand advanced tools and techniques in digital systems design including Hardware Modeling and Compilation Techniques. • Explain details of Logic-Level synthesis and optimization techniques for combinational and sequential circuits. • Explain the concept of scheduling and resource binding for optimization. 			
Modules			RBT Level
Module 1			
<p>Introduction to Synthesis and optimization: Design of Microelectronics circuits, Computer aided Synthesis and Optimization. Hardware Modeling: HDLs for Synthesis, Abstract models, Compilation and Behavioral Optimization. (Text1: Topics from Chap. 1,3)</p>			L1, L2, L3
Module 2			
<p>Graph theory for CAD for VLSI: Graphs, Combinatorial Optimization, Graph Optimization problems and Algorithms, Boolean Algebra and Applications. Architectural Synthesis and Optimization: Fundamental Architectural Synthesis problems, Area and Performance Estimation, Strategies for Architectural Optimization, Data path Synthesis, Control Path Synthesis.(Text1: Topics From Chap. 2,4)</p>			L1, L2, L3
Module 3			
<p>Two level Combinational Logic Optimization: Introduction, Logic Optimizations, Operations on Two level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems. Multiple Level Combinational Logic Optimization: Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model. (Text1: Chap. 7, 8)</p>			L1, L2, L3
Module 4			
<p>Sequential Logic Optimization: Introduction, Sequential Logic Optimization using State based Models, Sequential Logic Optimization using Network Models, Implicit FSM Traversal Methods, Testability concerns for</p>			L1, L2, L3

Synchronous Circuits. (Text 1: Chap. 9)	
Module 5	
<p>Scheduling Algorithms: Introduction, A Model for Scheduling problems, Scheduling with Resource Constraints, Scheduling without Resource Constraints, Scheduling Algorithms for Extended Sequencing Models, Scheduling Pipelined Circuits.</p> <p>Resource Sharing and Binding: Sharing and Binding for Resource dominated circuits, Sharing and Binding for General Circuits, Concurrent Binding and Scheduling, Resource sharing and Binding for Non – Scheduled Sequencing Graphs. (Text1: Chap. 5,6)</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the process of synthesis and optimization in a top down approach for digital circuits models using HDLs. • Understand the terminologies of graph theory and its algorithms to optimize a Boolean equation. • Apply different two level and multilevel optimization algorithms for combinational circuits • Apply the different sequential circuit optimization methods using state models and network models. • Apply different scheduling algorithms with resource binding and without resource binding for pipelined sequential circuits and extended sequencing models. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Giovanni De Micheli, –Synthesis and Optimization of Digital Circuits , Tata McGraw-Hill, 2003.</p>	
<p>Reference Book: Edwars M.D., Automatic Logic synthesis Techniques for Digital Systems, Macmillan New Electronic Series, 1992.</p>	

Advances in Image Processing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ECS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Acquire fundamental knowledge in understanding the representation of the digital image and its properties • Equip with some pre-processing techniques required to enhance the image for further analysis purpose. • Select the region of interest in the image using segmentation techniques. • Represent the image based on its shape and edge information. • Describe the objects present in the image based on its properties and structure. 			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and watersheds.			L1, L2, L3
Course Outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Understand the representation of the digital image and its properties • Apply pre-processing techniques required to enhance the image for its further analysis. 			

Use segmentation techniques to select the region of interest in the image for analysis

- Represent the image based on its shape and edge information.
- Describe the objects present in the image based on its properties and structure.
- Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, –Image Processing, Analysis, and Machine Visionll , Cengage Learning, 2013, ISBN: 978-81-315-1883-0

Reference Books:

1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010
2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011

**SCHEME OF TEACHING AND EXAMINATION
M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS**

I SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16ELD11	Advanced Engineering Mathematics	4	-	3	20	80	100	4
2	16EVE12	Digital VLSI Design	4	-	3	20	80	100	4
3	16EVE13	Advanced Embedded System	4	-	3	20	80	100	4
4	16EVE14	Low Power VLSI Design	4	-	3	20	80	100	4
5	16EXX15X	Elective-1	3	-	3	20	80	100	3
6	16EVEL16	VLSI and ES Lab -1		3	3	20	80	100	2
7	16EVE17	Seminar on advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective -1	
16 EVE151	Digital System Design Using Verilog

M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS

II SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16EVE21	Design of Analog and Mixed mode VLSI Circuits	4	-	3	20	80	100	4
2	16EVE22	VLSI Testing	4	-	3	20	80	100	4
3	16EVE23	Advances in VLSI Design	4	-	3	20	80	100	4
4	16EVE24	Real Time Operating System	4	-	3	20	80	100	4
5	16EXX25X	Elective -2	3	-	3	20	80	100	3
6	16EVEL26	VLSI and ES Lab -2		3	3	20	80	100	2
7	16EVE27	Seminar on Advanced topics from refereed journals	-	3	-	100	-	100	1
TOTAL			19	6	18	220	480	700	22

Elective -2	
16EVE254	SoC Design

M.Tech in VLSI DESIGN AND EMBEDDED SYSTEMS

III SEMESTER: Internship

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination			Credit	
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks		Total Marks
1	16EVE31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	-	-	-	25	-	25	20
2	16EVE32	Report on Internship	-	-	-	25	-	25	
3	16EVE33	Evaluation and Viva-Voce of Internship	-	-	-	-	50	50	
4	16EVE34	Evaluation of Project phase -1	-	-	-	50	-	50	1
TOTAL			-	-	-	100	50	150	21

M.Tech. in VLSI DESIGN AND EMBEDDED SYSTEMS

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Hours /Week		Examination				Credit
			Theory	Practical/Field Work/Assignment	Duration	I.A. Marks	Theory/Practical Marks	Total Marks	
1	16ELD41	Synthesis and Optimization of Digital Circuits	4	-	3	20	80	100	4
2	16EXX42X	Elective-3	3	-	3	20	80	100	3
3	16EVE43	Evaluation of Project phase -2	-	-	-	50	-	50	3
4	16EVE44	Evaluation of Project and Viva-Voce	-	-	-	-	100+100	200	10
TOTAL			-	-	6	90	360	450	20

Elective -3	
16ECS422	Advances in Image Processing

Note:

1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted.

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.Tech-VLSI & ES-2016-FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS

[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	16ELD11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Acquaint with principles of linear algebra, calculus of variations, probability theory and random process.
- Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences.

Modules	Revised Bloom's Taxonomy (RBT) Level
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Module -1

Linear Algebra-I

Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank-Nullity theorem(without proof). Matrix form of linear transformations-Illustrative examples.(**Text 1 & Ref. 1**)

L1,L2

Module -2

Linear Algebra-II

Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations.(**Text 1 & Ref. 1**)

L1,L2

Module -3

Calculus of Variations

Concept of functional-Eulers equation. functional dependent on first and higher order derivatives, functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.(**Text 2 & Ref. 2**)

L1,L2

Module -4

<p>Probability Theory Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Binomial, Poisson, Exponential, Gaussian and Rayleigh distributions-examples.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Module -5</p>	
<p>Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Statement of central limit theorem-Illustrative examples. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process.(Text 3 & Ref. 3)</p>	<p>L1,L2</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images. • Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems. • Utilize the concepts of functionals and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits. • Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications. • Apply the idea of joint probability distributions and the role of parameter-dependent random variables in random process. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	

Text Books:

1. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, —Advanced Engineering Mathematics II , 10th edition, Wiley, 2015.
3. Scott L.Miller, Donald G. Childers: —Probability and Random Process with application to Signal Processing II , Elsevier Academic Press, 2nd Edition,2013.

Reference books:

1. Richard Bronson: —Schaum's Outlines of Theory and Problems of Matrix Operations II , McGraw-Hill, 1988.
2. Elsgolts, L.: II Differential Equations and Calculus of Variations II , MIR Publications, 3rd Edition, 1977.
3. T.Veerarajan: —Probability, Statistics and Random Process—, 3rd Edition, Tata McGraw Hill Co.,2008.

Web links:

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics/>
4. www.wolfram.com

DIGITAL VLSI DESIGN			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER –I			
Subject Code	16EVE12	IA Marks	20
Number	04	Exam Marks	80
Total Number of	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain VLSI Design Methodologies • Learn Static and Dynamic operation principles, analysis and design of inverter circuit. • Infer state of the art Semiconductors Memory circuits. • Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits. • Illustrate VLSI and ASIC design. 			
Modules			Revised Bloom's Taxonomy (RBT) Level
Module -1			
<p>MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.</p> <p>MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.</p>			L1, L2
Module -2			
<p>MOS Inverters-Static Characteristics: CMOS Inverter.</p> <p>MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.</p>			L2, L3
Module -3			

<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>	<p>L1, L2, L3</p>
<p>Module -4</p>	
<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and $L(di/dt)$ Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Sung Mo Kang & Yosuf Leblebici, –CMOS Digital Integrated Circuits: Analysis and Designll , Tata McGraw-Hill, Third Edition.</p>	

Reference Books:

1. Neil Weste and K. Eshragian, —Principles of CMOS VLSI Design: A System Perspective, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.
2. Wayne, Wolf, —Modern VLSI Design: System on Silicon, Prentice Hall PTR/Pearson Education, Second Edition, 1998.
3. Douglas A Pucknell & Kamran Eshragian, —Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).

ADVANCED EMBEDDED SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Subject Code	16EVE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Describe the hardware software co-design and firmware design approaches
- Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions.
- Program ARM CORTEX M3 using the various instructions, for different applications.

Modules**Revised Bloom's Taxonomy (RBT) Level****Module -1**

Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).

L1, L2, L3**Module -2**

Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).

L1, L2, L3

Module -3	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)	L1, L2, L3
Module -4	
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6)	L1, L2, L3
Module -5	
Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10)	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> ● Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. ● Explain the hardware software co-design and firmware design approaches. ● Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. ● Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, –The Definitive Guide to the ARM Cortex-M3, 2ndedn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

LOW POWER VLSI DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER -I

Subject Code	16EVE14	IA Marks	20
Number of Lecture	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to:

- Know the basics and advanced techniques in low power design which is a hot topic in today's market where the power plays a major role.
- Describe the various power reduction and the power estimation methods.
- Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system
- Apply State-of-the art approaches to power estimation and reduction.
- Practice the low power techniques using current generation design style and process technology

Modules

**Revised
Bloom's
Taxonom**

Module -1

Introduction: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS leakage current, static current, basic principles of low power design, low power figure of merits.

Simulation power analysis: SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. (Text 1)

L1, L2

Module -2

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

Circuit: Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage. (Text 1)

L1, L2, L3

Module -3

Logic: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic (Text 1).

Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network (Text 2).

L1, L2, L3

Module -4

<p>Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation (Text 1).</p> <p>Low power arithmetic components: Introduction, circuit design style, adders, multipliers, division (Text 2).</p>	L1- L4
Module -5	
<p>Low power memory design: Introduction, sources and reductions of power dissipation in memory subsystem, sources of power dissipation in DRAM and SRAM (Text 2).</p> <p>Algorithm & Architectural Level Methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis (Text 2).</p> <p>Advanced Techniques: Adiabatic computation, pass transistor, Asynchronous circuits (Text 1).</p>	L1-L4
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Identify the sources of power dissipation in CMOS circuits. • Perform power analysis using simulation based approaches and probabilistic analysis. • Use optimization and trade-off techniques that involve power dissipation of digital circuits. • Make the power design a reality by making power dimension an integral part of the design process • Use practical low power design techniques and their analysis at various levels of design abstraction and analyse how these are being captured in the latest design automation environments. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic, 1998. 2. Jan M.Rabaey, Massoud Pedram, “Low Power Design Methodologies”, Kluwer Academic, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000 2. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, “ Low power VLSI CMOS circuit design”, Kluwer Academic,1995. 	

DIGITAL SYSTEM DESIGN USING VERILOG			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – I			
Subject Code	16EVE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Understand the concepts of Verilog Language ● Design the digital systems as an activity in a larger systems design context. ● Study the design and operation of semiconductor memories frequently used in application specific digital system. ● Inspect how effectively IC's are embedded in package and assembled in PCB's for different application ● Design and diagnosis of processors and I/O controllers they can be used in embedded systems 			
Modules			Revised Bloom's Taxonomy (RBT)
Module -1			
Introduction and Methodology: Digital Systems and Embedded Systems, Binary representation and Circuit Elements, Real-World Circuits, Models, Design Methodology.			L1, L2
Module -2			
Number Basics: Unsigned and Signed Integers, Fixed and Floating-point Numbers. Sequential Basics: Storage elements, Counters, Sequential Data paths and Control, Clocked Synchronous Timing Methodology.			L1, L2
Module -3			
Memories: Concepts, Memory Types, Error Detection and Correction. Implementation Fabrics: ICs, PLDs, Packaging and Circuit Boards, Interconnection and Signal Integrity.			L1, L2
Module -4			
Processor Basics: Embedded Computer Organization, Instruction and Data, Interfacing with memory. I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software.			L2, L3
Module -5			

<p>Accelerators: Concepts, case study, Verification of accelerators. Design Methodology: Design flow, Design optimization, Design for test.</p>	<p>L2, L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Design embedded systems, using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores. • Design the combinational circuits using discrete gates and programmable logic devices. • Describe Verilog model for sequential circuits and test pattern generation • Explore the different types of semiconductor memories and their usage for specific chip design • Synthesis different types of processor and I/O controllers that are used in embedded system design 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> · The question paper will have 10 full questions carrying equal marks. · Each full question consists of 16 marks with a maximum of four sub questions. · There will be 2 full questions from each module covering all the topics of the module · The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Peter J. Ashenden, –Digital Design: An Embedded Systems Approach Using VERILOG^{II} , Elsevier, 2010.</p>	
<p>Reference Book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Samir Palnitkar.</p>	

VLSI and ES LAB - 1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory Code	16EVEL16	IA Marks	20
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Marks	80
		Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to:

- Learn Verilog Code Programming for the design of digital circuits
- Use FPGA/CPLD board and Logic Analyzer or Chipscope to verify the results
- Learn Assembly language programming for different applications using ARM-Cortex M3 Kit and Keil uVision- 4 tool.
- Learn C language programming for different applications using ARM- Cortex M3 Kit and Keil uVision-4 tool.

Laboratory Experiments:

**Revised
Bloom's
Taxonomy**

- 1) **Digital Design Experiments:** Using Verilog code and any Compiler. Download code to FPGA/CPLD board and verify the output using Logic Analyzer or Chipscope
- a) Design and verify an 8 to 3 programmable priority encoder
 - b) Design and verify 3-bit Arbitrary Counter and repeat the given sequence
 - c) Design and Verify BCD adder and subtractor
 - d) Design and verify a sequential block to generate a sequence (say 11101) using appropriate FSM.
 - e) Design and verify 8 bit Ripple carry adder and Carry skip adder.
 - f) Design and verify a Linear feedback shift register based on a given polynomial expression
 - g) Design and verify the following 8 bit multipliers. Also report on area delay trade-off
 - i) Serial Multiplier
 - ii) Parallel Multiplier
 - h) Design and verify a parameterized FIFO
 - i) Design and verify register file which has 32-entry 3-ports having explicit address decoder. The ports are dedicated for read and write and will take one clock cycle for read or write operation

L2,L3,L4

<p>2) ARM Cortex M3 Programs: (Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ATSAM3U)</p> <ol style="list-style-type: none"> a) Write an Assembly language program to calculate the sum and display the result for the addition of first ten numbers. SUM = 10+9+8+. +1 b) Write a Assembly language program to link multiple object files and link them together c) Write an Assembly language program to store data in RAM d) Write a C program to Output the –Hello World message using UART e) Write a C program to Design a Stopwatch using interrupts 	<p>L2,L3,L4</p>
<p>Course outcomes: On the completion of this laboratory course, the students will be able to:</p> <ul style="list-style-type: none"> • Develop Verilog Code for the design of digital circuits • Use FPGA/CPLD board and Logic Analyzer or Chipscope to verify the results • Develop Assembly language programs for different applications using ARM-Cortex M3 Kit and Keil uVision-4 tool. • Develop C language programs for different applications using ARM-Cortex M3 Kit and Keil uVision-4 tool 	
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, two questions using different tool to be set. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero. 	

M.Tech-VLSI & ES-2016-SECOND SEMESTER SYLLABUS

Design of Analog and Mixed Mode VLSI Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE21	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> ● Describe basic physics and operation of MOS devices. ● Exemplify single-stage and differential amplifiers and current mirrors ● Describe operational amplifiers ● Learn the design of phase-locked-loops ● Know the role of Data converters in an ever-increasing digital world. 			
Modules			RBT Level
Module 1			
Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.			L1, L2
Single stage Amplifier: Basic Concepts, Common Source stage.(Text 1)			
Module 2			
Single stage Amplifier: Source follower, common-gate stage, Cascode Stage, choice of device models.			L1,L2
Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common mode response, Differential pair with MOS loads, Gilbert cell. (Text 1)			
Module 3			
Passive and Active Current Mirrors: Basic current mirrors, Cascode Current mirrors, Active Current mirrors.			L1,L2,L3
Operational Amplifiers (part-1): General Considerations, One Stage OP-Amp, Two Stage OP-Amp, Gain boosting. (Text 1)			
Module 4			
Operational Amplifiers (part-2): Common Mode Feedback, Slew rate, Power Supply Rejection.			L1,L2,L3
Phase Locked Loops: Simple PLL, Charge pump PLLs, Non-ideal effects in PLLs, Delay-Locked Loops, Applications. (Text 1)			
Module 5			
Data Converter Architectures: DAC & ADC Specifications, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. (Text 2)			L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

- Use efficient analytical tools for quantifying the behaviour of basic circuits by inspection.
- Design high-performance, stable operational amplifiers with the trade-offs between speed, precision and power dissipation.
- Design and study the behaviour of phase-locked-loops for the applications.
- Identify the critical parameters that affect the analog and mixed-signal VLSI circuits' performance
- Perform calculations in the digital or discrete time domain, more sophisticated data converters to translate the digital data to and from inherently analog world.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Behzad Razavi, –Design of Analog CMOS Integrated Circuits|| , TMH, 2007.
2. R. Jacob Baker, –CMOS Circuit Design, Layout, and Simulation|| , Second Edition, Wiley.

Reference Book:

Phillip E. Allen, Douglas R. Holberg, –CMOS Analog Circuit Design|| , Second Edition, Oxford University Press.

VLSI Testing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE22	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn various types of faults and fault modeling • Comprehend the need for testing and testable design of digital circuits • Illustrate methods and algorithms for testing digital combinatorial networks and test pattern generation • Exemplify methods for testing sequential circuits and memory testing • Inferring testing methods using Boundary scan, Built-in self test and other advanced topics in digital circuit design. 			
Modules			RBT Level
Module 1			
<p>Faults in digital circuits: Failures and Faults, Modeling of faults, Temporary Faults. (Text 1)</p> <p>Logic Simulation: Applications, Problems in simulation based design verification, types of simulation, The unknown logic values, compiled simulation, event-driven simulation, Delay models, Element evaluation, Hazard detection, Gate-level event-driven Simulation. (Text 2)</p>			L1,L2
Module 2			
<p>Test generation for Combinational Logic circuits: Fault Diagnosis of digital circuits, Test generation techniques for combinational circuits, Detection of multiple faults in Combinational logic circuits. (Text 1)</p> <p>Testable Combinational logic circuit design: The Read-Muller expansion technique, Three level OR-AND-OR design, Automatic synthesis of testable logic.(Text 1)</p>			L1,L2,L3
Module 3			
<p>Testable Combinational logic circuit design: Testable design of multilevel combinational circuits, Synthesis of random pattern testable combinational circuits, Path delay fault testable combinational logic design, Testable PLA design. (Text 1)</p> <p>Test generation for Sequential circuits: Testing of sequential circuits as Iterative combinational circuits, state table verification, Test generation based on Circuit Structure, Functional Fault models, test Generation based on Functional Fault models. (Text 1)</p>			L1,L2,L3
Module 4			
<p>Design of testable sequential circuits: Controllability and observability, Ad-Hoc design rules for improving testability, design of</p>			L1,L2,L3

<p>diagnosable sequential circuits, the scan-path technique for testable sequential circuit design, Level Sensitive Scan Design(LSSD), Random Access Scan Technique, Partial scan, testable sequential circuit design using Nonscan Techniques, Cross check, Boundary Scan. (Text 1)</p>	
<p>Module 5</p>	
<p>Built-In Self Test: Test pattern generation for BIST, Output response analysis, Circular BIST, BIST Architectures. (Text 1)</p>	<p>L1,L2,L3</p>
<p>Testable Memory Design: RAM Fault Models, Test algorithms for RAMs, Detection of pattern-sensitive faults, BIST techniques for RAM chips, Test generation and BIST for embedded RAMs. (Text1)</p>	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Analyze the need for fault modeling and testing of digital circuits • Generate fault lists for digital circuits and compress the tests for efficiency • Create tests for digital memories and analyze failures in them • Apply boundary scan technique to validate the performance of digital circuits • Design built-in self tests for complex digital circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Lala Parag K., Digital Circuit Testing and Testability, New York, Academic Press, 1997. 2. Abramovici M, Breuer M A and Friedman A D, –Digital Systems Testing and Testable Designll , Wiley, 1994. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Vishwani D Agarwal, –Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuitsll , Springer, 2002. 2. Wang, Wu and Wen, –VLSI Test Principles and Architecturesll , Morgan Kaufmann, 2006. 	

Advances in VLSI Design [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Learn circuit-oriented approach towards digital design • Illustrate the impact of interconnect wiring on the functionality and performance of a digital gate. • Infer different approaches to digital timing and clocking circuits • Understand the impact of clock skew on the behaviour of digital synchronous circuits • Explain the role of peripheral circuitry such as the decoders, sense amplifiers, drivers and control circuitry in the design of reliable and fast memories 			
Modules			RBT Level
Module 1			
Implementation Strategies For Digital ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective-The Implementation Platform of the Future.			L1,L2,L3
Module 2			
Coping With Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability-Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability-Ohmic Voltage Drop, Electromigration, Resistance and Performance-RC Delay, Inductive Parasitics, Inductance and Reliability-Voltage Drop, Inductance and Performance-Transmission Line Effects, Advanced Interconnect Techniques, Reduced-Swing Circuits, Current-Mode Transmission Techniques, Perspective: Networks-on-a-Chip.			L1,L2,L3
Module 3			
Timing Issues In Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Based Clocking, Self-Timed Circuit Design, Self-Timed Logic - An Asynchronous			L1,L2,L3

Technique, Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters, Synchronizers-Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL.	
Module 4	
Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control.	L1,L2,L3
Module 5	
Designing Memory and Array Structures: Memory Reliability and Yield, Signal-to-Noise Ratio, Memory yield, Power Dissipation in Memories, Sources of Power Dissipation in Memories, Partitioning of the memory, Addressing the Active Power Dissipation, Data-retention dissipation, Case Studies in Memory Design: The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory, Perspective: Semiconductor Memory Trends and Evolutions.	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Apply design automation for complex circuits using the different implementation methodology like custom versus semi-custom, hardwired versus fixed, regular array versus ad-hoc. • Use the approaches to minimize the impact of interconnect parasitics on performance, power dissipation and circuit reliability • Impose the ordering of the switching events to meet the desired timing constraints using synchronous, clocked approach. • Infer the reliability of the memory 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book:</p> <p>Jan M Rabey, Anantha Chandrakasan, Borivoje Nikolic, –Digital Integrated Circuits-A Design Perspectivell , PHI, 2nd Edition.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. M. Smith, –Application Specific Integrated circuitsll , Addison Wesley, 1997 2. H. Veendrick, –MOS IC’s: From Basics to ASICs, Wiley-VCH, 1992. 3. Anantha P. Chandrakasan , Robert W. Brodersen, –Low Power Digital CMOS Designll , Kluwer Academic Publisher, 1995. 	

Real Time Operating System [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging			L1,L2,L3

<p>Components, Exceptions, assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace Ports, External test equipment. (Text 1: Selected topics from Chap. 8,9)</p>	
<p>Module 5</p>	
<p>Process and Threads: Process and thread creations, Simple Programs, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication using multiple threads. (Text 2: Chap. 11)</p>	<p>L1,L2,L3</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. • Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC to improve the system performance. • Apply priority based static and dynamic real time scheduling techniques for the given specifications. • Analyze deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. • Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, –Real-Time Embedded Systems and Componentsll , Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, Dream Tech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, –Real Time Systemll , Pearson education, 2008. 2. Dream Tech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008. 	

SoC Design			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	16EVE254	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Describe the ARM processor architecture and user-level assembly language programming • Appreciate what a high-level language (in this case, C) really needs and how those needs are met by the ARM instruction set. • raises the issues involved in debugging systems which use embedded processor cores and in the production testing of board-level systems. • Learn the concept of memory hierarchy, discussing the principles of memory management and caches. 			
Modules			RBT Level
Module 1			
<p>ARM Organization and Implementation: 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.</p> <p>The ARM Instruction Set : Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instruction, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions, Coprocessor instructions, Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture v5T only), Unused instruction space, Memory faults, ARM architecture variants.</p>			L1,L2
Module 2			
<p>Architectural Support for High-Level Languages: Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, Use of memory, Run-time environment.</p> <p>Architectural Support for System Development: The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA), The ARM reference peripheral specification, Hardware system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, Embedded Trace,</p>			L1,L2

Signal processing support.	
Module 3	
ARM Processor Cores: ARM7TDMI, ARM8,ARM9TDMI, ARM10TDMI ,Discussion ,Example and exercises. Memory Hierarchy: Memory size and speed, On-chip memory, Caches, Cache design - an example, Memory management, Examples and exercises.	L1,L2
Module 4	
Architectural Support for Operating Systems: An introduction to operating systems, The ARM system control coprocessor, CP15 protection unit registers, ARM protection unit,CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/ Output, Example and exercises. ARM CPU Cores: The ARM710T, ARM720T and ARM740T, The ARM810,The Strong ARM SA-110,The ARM920T and ARM940T,The ARM946E-S and ARM966E-S,The ARM1020E,Discussion,Example and exercises.	L1,L2
Module 5	
Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The One C™ VWS22100 GSM chip, The Ericsson-VLSI Bluetooth Baseband Controller, The ARM7500 and ARM7500FE, The ARM7100 364,The SA-1100 368,Examples and exercises. The AMULET Asynchronous ARM Processors: Self-timed design 375,AMULET1 377,AMULET2 381,AMULET2e 384,AMULET3 387,The DRACO telecommunications controller 390, A self-timed future? 396,Example and exercises.	L1,L2,L3
Course Outcomes: After studying this course, students will be able to: <ul style="list-style-type: none"> • Apply the 3- and 5-stage pipeline ARM processor cores and analyse the implementation issues. • Use the concepts and methodologies employed in designing a System-on-chip (SoC) based around a microprocessor core and in designing the microprocessor core itself. • Understand how SoCs and microprocessors are designed and used, and why a modern processor is designed the way that it is. • Use integrated ARM CPU cores (including StrongARM) that incorporate full support for memory management. • Analyze the requirements of a modern operating system and use the ARM architecture to address the same. 	
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
Text Book: Steve Furber, –ARM System-On-Chip Architecture, Addison Wesley, 2nd edition.	

References Books:

1. Joseph Yiu, —The Definitive Guide to the ARM Cortex-M3ll , 2nd edn, Newnes, (Elsevier), 2010.
2. Sudeep Pasricha and Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnectll , Morgan Kaufmann, Publishers © 2008.
3. Michael Keating, Pierre Bricaud, —Reuse Methodology Manual for System on Chip designsll , Kluwer Accademic Publishers, 2nd edition, 2008.

VLSI and ES Lab-2			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – II			
Laboratory Code	16EVEL26	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	01Hr Tutorial (Instructions) + 02 Hours Laboratory	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This laboratory course enables students to:</p> <ul style="list-style-type: none"> • Learn the CAD tool and the flow of the Full Custom IC design cycle. • Learn running DRC, LVS and Parasitic Extraction of the various designs. • Create various components like inverter, differential amplifier and use the same in the design of operational amplifier, R-2R based DAC and ADC. • Understand the suitability of different techniques of IPC and task switching in a multithreaded application. • Study and implement different types of data structures required to implement inter task communication. • Implement Inter task communication using an appropriate data structure. 			
Part – A: Experiments to be done using CADENCE/SYNOPSIS/MENTOR GRAPHICS/TANNER Tool			RBT Level
<p>1. Design an Inverter with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) Transient Analysis b. Draw the Layout and verify the DRC, ERC c. Check for XX d. Extract RC and back annotate the same and verify the Design e. Verify & Optimize for Time, Power and Area to the given constraint*** <p>(Following specification may be used to design an Inverter in gpdk 180nm technology with minimum area:</p> <ol style="list-style-type: none"> i. Maximum output rise time=100ps ii. Maximum output fall time=100ps iii. $P_{avg} \leq 15\mu w$ iv. Load capacitance= 50fF v. Input rise time=200ps vi. Input fall time=200ps <p>Choose maximum frequency based on the power)</p>			L3
<p>Design the following circuits with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) AC Analysis iii) Transient Analysis 			L3

<ul style="list-style-type: none"> b. Draw the Layout and verify the DRC, ERC, LVS c. Check for XX d. Extract RC and back annotate the same and verify the Design. <ul style="list-style-type: none"> 2. i) A Single Stage differential amplifier ii) Common source amplifier 3. Design an op-amp with given specification* using given differential amplifier Common source amplifier in library** 4. Design a 4 bit R-2R based DAC for the given specification** 	
<p>5. Design an Integrator and Differentiator using OPAMP (First Order)</p>	
<p>6. Design and characterize a basic Sigma delta ADC from the available designs.</p>	
<p>7. Design a simple NAND/NOR gate using any one of the tools given above.</p> <p>(Any other experiments may be added in supportive of the course) * Appropriate specification should be given. ** Applicable Library should be added & information should be given to the Designer. *** An appropriate constraint should be given</p>	
Part – B: Experiments to be done using Linux	
<p>1. Develop and test programs to (a) create child process and display it's id and (b) Execute child process function using switch structure</p>	
<p>2. Develop and test program for a multithreaded application, where communication is through a buffer for the conversion of lowercase text to uppercase text, using semaphore concept.</p>	
<p>3. Develop and test program for a multithreaded application, where communication is through shared memory for the conversion of lowercase text to uppercase text.</p>	
<p>4. Develop program for inter-thread communication using message queue. Data is to be input from the keyboard for the chosen application.</p>	
<p>5. Create '_n' number of child threads. Each thread prints the message –I'm in thread number ... and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux.</p>	
<p>6. Implement the multi-thread application satisfying the following :</p> <ul style="list-style-type: none"> i. Two child threads are created with normal priority. ii. Thread 1 receives and prints its priority and sleeps for 50ms and then quits. iii. Thread 2 prints the priority of the thread 1 and rises its priority to above normal and retrieves the new priority of thread 1, prints it and then quits. iv. The main thread waits for the child thread to complete its job and 	L3

quits.	
7. Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism	
<p>Course outcomes: This laboratory course enable the students to:</p> <ul style="list-style-type: none"> • Design Analog, digital and mixed mode circuits • Learn the various issues in Mixed signal designs basically data converters. • Acquire hands-on skills of using CAD tools in VLSI design. • Appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system. • Select a suitable task switching technique in a multithreaded application. • Implement different techniques of message passing and Inter task communication. • Implement different data structures such as pipes, queues and buffers in multithreaded programming. 	
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one experiment from Part-A and One experiment from Part-B is to be set. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the Procedure part to be made zero. 	
<p>Reference Book: (for some of the Part-B programs) Dreamtech Software Team, –Programming for Embedded Systemsll , John Wiley, India Pvt. Ltd., 2008.</p>	

M.Tech-VLSI & ES-2016-FOURTH SEMESTER SYLLABUS

Synthesis and Optimization of Digital Circuits [As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ELD41	IA Marks	20
Number of Lecture Hours/Week	04	Exam marks	80
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students:</p> <ul style="list-style-type: none"> • Understand the need for optimization and dimensions of optimization for digital circuits. • Understand basic optimization techniques used in circuits design • Understand advanced tools and techniques in digital systems design including Hardware Modeling and Compilation Techniques. • Explain details of Logic-Level synthesis and optimization techniques for combinational and sequential circuits. • Explain the concept of scheduling and resource binding for optimization. 			
Modules			RBT Level
Module 1			
<p>Introduction to Synthesis and optimization: Design of Microelectronics circuits, Computer aided Synthesis and Optimization. Hardware Modeling: HDLs for Synthesis, Abstract models, Compilation and Behavioral Optimization. (Text1: Topics from Chap. 1,3)</p>			L1, L2, L3
Module 2			
<p>Graph theory for CAD for VLSI: Graphs, Combinatorial Optimization, Graph Optimization problems and Algorithms, Boolean Algebra and Applications. Architectural Synthesis and Optimization: Fundamental Architectural Synthesis problems, Area and Performance Estimation, Strategies for Architectural Optimization, Data path Synthesis, Control Path Synthesis.(Text1: Topics From Chap. 2,4)</p>			L1, L2, L3
Module 3			
<p>Two level Combinational Logic Optimization: Introduction, Logic Optimizations, Operations on Two level Logic Covers, Algorithms for Logic Minimization, Symbolic Minimization and Encoding Problems. Multiple Level Combinational Logic Optimization: Introduction, Models and Transformations for Combinational Networks, The Algebraic Model, The Boolean Model. (Text1: Chap. 7, 8)</p>			L1, L2, L3
Module 4			
<p>Sequential Logic Optimization: Introduction, Sequential Logic Optimization using State based Models, Sequential Logic Optimization using Network Models, Implicit FSM Traversal Methods, Testability concerns for</p>			L1, L2, L3

Synchronous Circuits. (Text 1: Chap. 9)	
Module 5	
<p>Scheduling Algorithms: Introduction, A Model for Scheduling problems, Scheduling with Resource Constraints, Scheduling without Resource Constraints, Scheduling Algorithms for Extended Sequencing Models, Scheduling Pipelined Circuits.</p> <p>Resource Sharing and Binding: Sharing and Binding for Resource dominated circuits, Sharing and Binding for General Circuits, Concurrent Binding and Scheduling, Resource sharing and Binding for Non – Scheduled Sequencing Graphs. (Text1: Chap. 5,6)</p>	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the process of synthesis and optimization in a top down approach for digital circuits models using HDLs. • Understand the terminologies of graph theory and its algorithms to optimize a Boolean equation. • Apply different two level and multilevel optimization algorithms for combinational circuits • Apply the different sequential circuit optimization methods using state models and network models. • Apply different scheduling algorithms with resource binding and without resource binding for pipelined sequential circuits and extended sequencing models. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have 10 full questions carrying equal marks. • Each full question consists of 16 marks with a maximum of four sub questions. • There will be 2 full questions from each module covering all the topics of the module • The students will have to answer 5 full questions, selecting one full question from each module. 	
<p>Text Book: Giovanni De Micheli, –Synthesis and Optimization of Digital Circuits , Tata McGraw-Hill, 2003.</p>	
<p>Reference Book: Edwars M.D., Automatic Logic synthesis Techniques for Digital Systems, Macmillan New Electronic Series, 1992.</p>	

Advances in Image Processing			
[As per Choice Based credit System (CBCS) Scheme SEMESTER – IV			
Subject Code	16ECS422	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Acquire fundamental knowledge in understanding the representation of the digital image and its properties • Equip with some pre-processing techniques required to enhance the image for further analysis purpose. • Select the region of interest in the image using segmentation techniques. • Represent the image based on its shape and edge information. • Describe the objects present in the image based on its properties and structure. 			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and watersheds.			L1, L2, L3
Course Outcomes: After studying this course, students will be able to:			
<ul style="list-style-type: none"> • Understand the representation of the digital image and its properties • Apply pre-processing techniques required to enhance the image for its further analysis. 			

Use segmentation techniques to select the region of interest in the image for analysis

- Represent the image based on its shape and edge information.
- Describe the objects present in the image based on its properties and structure.
- Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects.

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, –Image Processing, Analysis, and Machine Visionll , Cengage Learning, 2013, ISBN: 978-81-315-1883-0

Reference Books:

1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010
2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI											
Scheme of Teaching and Examination: 2018-19											
M.Tech in VLSI Design & Embedded Systems (EVE)											
Choice Based Credit System (CBCS)											
I SEMESTER											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks		
1	PCC	18ELD11	Advanced Engineering Mathematics	04	--	03	40	60	100	4	
2	PCC	18EVE12	ASIC Design	04	--	03	40	60	100	4	
3	PCC	18EVE13	Advanced Embedded System	04	--	03	40	60	100	4	
4	PCC	18EVE14	VLSI Testing	04	--	03	40	60	100	4	
5	PCC	18EVE15	Digital VLSI Design	04	--	03	40	60	100	4	
6	PCC	18EVEL16	VLSI & ES Lab-1	-	04	03	40	60	100	2	
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2	
TOTAL				22	04	21	280	420	700	24	
Note:- PCC: Professional Core Course											
<p>Internship: All the students shall undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. University examination will be conducted during III semester and prescribed credit shall be included in the III semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during subsequent University examination after satisfying the internship requirements.</p>											

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI										
Scheme of Teaching and Examination: 2018-19										
M.Tech in VLSI Design & Embedded Systems (EVE)										
Choice Based Credit System (CBCS)										
II SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18EVE21	Design of Analog and Mixed mode VLSI Circuits	04	--	03	40	60	100	4
2	PCC	18EVE22	Real Time Operating System	04	--	03	40	60	100	4
3	PCC	18EVE23	System Verilog	04	--	03	40	60	100	4
4	PEC	18XXX24X	Professional Elective 1	04	--	03	40	60	100	4
5	PEC	18XXX25X	Professional Elective 2	04	--	03	40	60	100	4
6	PCC	18EVEL26	VLSI & ES Lab-2	--	04	03	40	60	100	2
7	PCC	18EVE27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				20	06	18	340	360	700	24
Note:- PCC: Professional Core Course, PEC: Professional Elective Course										
Professional Elective 1					Professional Elective 2					
Course Code Under 18XXX24X		Course Title			Course Code Under 18XXX25X		Course Title			
18EVE241		Advances in VLSI Design			18EVE252		SoC Design			
Note: 1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide in any and a senior faculty of the department. Participation in seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory. The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.										
2. Internship: All the students shall undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination will be conducted during III semester and prescribed credit shall be included in the III semester. Internship shall be considered as head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during subsequent University examination after satisfying the internship requirements.										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI										
Scheme of Teaching and Examination: 2018-19										
M.Tech in VLSI Design & Embedded Systems (EVE)										
Choice Based Credit System (CBCS)										
III SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18EVE31	CAD of Digital Systems	04	--	03	40	60	100	4
2	PEC	18XXX32X	Professional Elective 3	04	--	03	40	60	100	4
3	PEC	18XXX33X	Professional Elective 4	04	--	03	40	60	100	4
4	Proj	18EVE34	Evaluation of Project Phase -1	--	02	--	100	--	100	2
5	INT	18EVE35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	260	240	500	20
Note:- PCC: Professional Core Course, PEC: Professional Elective Course, Proj: Project, INT: Internship										
Professional Elective 3					Professional Elective 4					
Course Code Under 18XXX32X	Course Title			Course Code Under 18XXX33X	Course Title					
18ECS321	Advances in Image Processing			18ECS333	Internet of Things					
Note:										
<p>1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.</p> <p>SEE (University examination) shall be as per the University norms.</p> <p>2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfy the internship requirements.</p> <p>Internship SEE (University examination) shall be as per the University norms.</p>										

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination: 2018-19 M.Tech in VLSI Design & Embedded Systems (EVE) Choice Based Credit System (CBCS)										
IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
1	Proj	18EVE41	Project Work Phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20
Note: Proj: Project.										
Note: 1. Project Phase-2: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any and a Senior faculty of the department. The CIE marks awarded for Project Work Phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.										

M.Tech-VLSI & ES-2018- FIRST SEMESTER SYLLABUS

ADVANCED ENGINEERING MATHEMATICS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER - I			
Course Code	18ELD11	CIE	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> To learn principles of advanced engineering mathematics through linear algebra and calculus of variations. To understand probability theory and random process that serve as an essential tool for applications of electronics and communication engineering sciences 			
Modules			(RBT) Level
Module -1			
Linear Algebra-I Introduction to vector spaces and sub-spaces, definitions, illustrative example. Linearly independent and dependent vectors- Basis-definition and problems. Linear transformations-definitions. Matrix form of linear transformations-Illustrative examples (Text Book:1).			L1,L2
Module -2			
Linear Algebra-II Computation of eigen values and eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process (Text. Book:1).			L1,L2
Module -3			
Calculus of Variations : - Concept of functional- Eulers equation. Functional dependent on first and higher order derivatives, Functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries. (Text.Book:2)			L1,L2
Module -4			
Probability Theory:- Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Poisson, Gaussian and Erlang distributions-examples. (Text Book: 3)			L1,L2
Module -5			

<p>Engineering Applications on Random processes:- Classification. Stationary, WSS and ergodic random process. Auto-correlation function-properties, Gaussian random process. (Text Book: 3)</p>	<p>L1,L2</p>
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images. 2. Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems. 3. Utilize the concepts of functional and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits. 4. Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications. 5. Analyze random process through parameter-dependent variables in various random processes. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	

ASIC DESIGN [As per Choice Based Credit System (CBCS) scheme] SEMESTER- I			
Subject Code	18EVE12	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Explain ASIC methodologies and programmable logic cells to implement a function on IC. • Analyse back-end physical design flow, including partitioning, floor-planning, placement, and routing. • Gain sufficient theoretical knowledge for carrying out FPGA and ASIC designs. • Design CAD algorithms and explain how these concepts interact in ASIC design. 			
Modules			(RBT) Level
Module -1			
Introduction to ASICs: Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. CMOS Logic: Data path Logic Cells: Data Path Elements, Adders: Carry skip, Carry bypass, Carry save, Carry select, Conditional sum, Multiplier (Booth encoding), Data path Operators, I/O cells, Cell Compilers.			L1,L2
Module -2			
ASIC Library Design: Logical effort: Predicting Delay, Logical area and logical efficiency, Logical paths, Multi stage cells, Optimum delay and number of stages, library cell design. Programmable ASIC Logic Cells: MUX as Boolean function generators, Acted ACT: ACT 1, ACT 2 and ACT 3 Logic Modules, Xilinx LCA: XC3000 CLB, Altera FLEX and MAX, Programmable ASIC I/O Cells: Xilinx and Altera I/O Block.			L1-L3
Module -3			
Low-level design entry: Schematic entry: Hierarchical design, The cell library, Names, Schematic Icons & Symbols, Nets, Schematic Entry for ASICs, Connections, vectored instances & buses, Edit in place, attributes, Netlist screener. ASIC Construction: Physical Design, CAD Tools System partitioning, Estimating ASIC size. Partitioning: Goals and objectives, Constructive Partitioning, Iterative Partitioning Improvement, KL, FM and Look Ahead algorithms.			L1-L4
Module -4			

<p>Floor planning and placement: Goals and objectives, Measurement of delay in Floor planning, Floor planning tools, Channel definition, I/O and Power planning and Clock planning.</p> <p>Placement: Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Time driven placement methods, Physical Design Flow.</p>	L1-L3
Module -5	
<p>Routing: Global Routing: Goals and objectives, Global Routing Methods, Global routing between blocks, Back-annotation. Detailed Routing: Goals and objectives, Measurement of Channel Density, Left-Edge Algorithm, Area-Routing Algorithms, Multilevel routing, Timing –Driven detailed routing, Final routing steps, Special Routing, Circuit extraction and DRC.</p>	L1-L3
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Describe the concepts of ASIC design methodology, data path elements, logical effort and FPGA architectures. 2. Analyze the design of FPGAs and ASICs suitable for specific tasks, perform design entry and explain the physical design flow. 3. Design data path elements for ASIC cell libraries and compute optimum path delay. 4. Create floor plan including partition and routing with the use of CAD algorithms. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book:</p> <ul style="list-style-type: none"> • Michael John Sebastian Smith, “Application - Specific Integrated Circuits” Addison-Wesley Professional; 2005. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Neil H.E. Weste, David Harris, and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, 3rd edition, Addison Wesley/ Pearson education, 2011. 2. Vikram Arkalgud Chandrasetty, “VLSI Design: A Practical Guide for FPGA and ASIC Implementations”, Springer, 2011, ISBN: 978-1-4614-1119-2. 3. Rakesh Chadha, Bhasker J., “An ASIC Low Power Primer”, Springer, ISBN: 978-1-4614-4270-7. 	

ADVANCED EMBEDDED SYSTEM [As per Choice Based Credit System (CBCS) scheme] SEMESTER - I			
Subject	18EVE13	CIE	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. • Describe the hardware software co-design and firmware design approaches • Explain the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. • Program ARM CORTEX M3 using the various instructions, for different applications. 			
Modules			(RBT) Level
Module -1			
<p>Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).</p>			L1, L2, L3
Module -2			
<p>Hardware Software Co-Design, embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics From Ch-7, 9, 12, 13).</p>			L1, L2, L3
Module -3			
<p>ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)</p>			L1, L2, L3
Module -4			
<p>Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface (Text 2: Ch-4, 5, 6).</p>			L1, L2, L3
Module -5			

Exceptions, Nested Vector interrupt controller design, SysTick Timer, Cortex-M3 Programming using assembly and C language, CMSIS (Text 2: Ch-7, 8, 10).	L1, L2, L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. 2. Explain the hardware software co-design and firmware design approaches. 3. Acquire the knowledge of the architectural features of ARM CORTEX M3, a 32 bit microcontroller including memory map, interrupts and exceptions. 4. Apply the knowledge gained for Programming ARM CORTEX M3 for different applications. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009. 2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd edn, Newnes, (Elsevier), 2010. 	
<p>Reference Book:</p> <p>James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008.</p>	

VLSI TESTING			
[As per Choice Based credit System (CBCS) Scheme			
SEMESTER – I			
Subject Code	18EVE14	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn various types of faults and fault modelling. • Comprehend the need for testing and testable design of digital circuits • Illustrate methods and algorithms for testing digital combinatorial networks and test pattern generation • Exemplify methods for testing sequential circuits and memory testing • Inferring testing methods using Boundary scan, Built-in self test and other advanced topics in digital circuit design. 			
Modules			RBT Level
Module 1			
<p>Faults in digital circuits: Failures and Faults, Modeling of faults, Temporary Faults. (Text 1)</p> <p>Logic Simulation: Applications, Problems in simulation based design verification, types of simulation, The unknown logic values, compiled simulation, event-driven simulation, Delay models, Element evaluation, Hazard detection, Gate-level event-driven Simulation. (Text 2)</p>			L1,L2
Module 2			
<p>Test generation for Combinational Logic circuits: Fault Diagnosis of digital circuits, Test generation techniques for combinational circuits, Detection of multiple faults in Combinational logic circuits. (Text 1)</p> <p>Testable Combinational logic circuit design: The Read-Muller expansion technique, Three level OR-AND-OR design, Automatic synthesis of testable logic.(Text 1)</p>			L1,L2,L3
Module 3			
<p>Testable Combinational logic circuit design: Testable design of multilevel combinational circuits, Synthesis of random pattern testable combinational circuits, Path delay fault testable combinational logic design, Testable PLA design. (Text 1)</p> <p>Test generation for Sequential circuits: Testing of sequential circuits as Iterative combinational circuits, state table verification, Test generation based on Circuit Structure, Functional Fault models, test Generation based on Functional Fault models. (Text 1)</p>			L1,L2,L3
Module 4			
<p>Design of testable sequential circuits: Controllability and observability, Ad-Hoc design rules for improving testability, design of diagnosable sequential circuits, the scan-path technique for testable</p>			L1,L2,L3

sequential circuit design, Level Sensitive Scan Design(LSSD), Random Access Scan Technique, Partial scan, testable sequential circuit design using Nonscan Techniques, Cross check, Boundary Scan. (Text 1)	
Module 5	
<p>Built-In Self Test: Test pattern generation for BIST, Output response analysis, Circular BIST, BIST Architectures. (Text 1)</p> <p>Testable Memory Design: RAM Fault Models, Test algorithms for RAMs, Detection of pattern-sensitive faults, BIST techniques for RAM chips, Test generation and BIST for embedded RAMs. (Text1)</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyze the need for fault modeling and testing of digital circuits 2. Generate fault lists for digital circuits and compress the tests for efficiency 3. Create tests for digital memories and analyze failures in them 4. Apply boundary scan technique to validate the performance of digital circuits 5. Design built-in self tests for complex digital circuits 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Lala Parag K., Digital Circuit Testing and Testability, New York, Academic Press, 1997. 2. Abramovici M, Breuer M A and Friedman A D, “Digital Systems Testing and Testable Design”, Wiley, 1994. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Vishwani D Agarwal, “Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuits”, Springer, 2002. 2. Wang, Wu and Wen, “VLSI Test Principles and Architectures”, Morgan Kaufmann, 2006. 	

DIGITAL VLSI DESIGN			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER -I			
Subject Code	18EVE15	CIE Marks	40
Number of Lecture Hours/Week of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS - 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Explain VLSI Design Methodologies • Learn Static and Dynamic operation principles, analysis and design of inverter circuit. • Infer state of the art Semiconductors Memory circuits. • Outline the comprehensive coverage of Methodologies and Design practice that are used to reduce the Power Dissipation of large scale digital circuits. • Illustrate VLSI and ASIC design 			
Modules			(RBT) Level
Module -1			
<p>MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects.</p> <p>MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.</p>			L1, L2
Module -2			
<p>MOS Inverters-Static Characteristics: CMOS Inverter.</p> <p>MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.</p>			L2, L3
Module -3			
<p>Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).</p>			L1, L2, L3
Module -4			

<p>Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS circuits.</p> <p>BiCMOS Logic Circuits: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.</p>	<p>L1,L2, L3</p>
<p>Module -5</p>	
<p>Chip Input and Output (I/O) Circuits: Introduction, ESD Protection, Input Circuits, Output Circuits and L(di/dt) Noise, On-Chip Clock Generation and Distribution, Latch-Up and Its Prevention.</p> <p>Design for Manufacturability: Introduction, Process Variations, Basic Concepts and Definitions, Design of Experiments and Performance Modeling.</p>	<p>L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Analyse issues of On-chip interconnect Modelling and Interconnect delay calculation. 2. Analyse the Switching Characteristics in Digital Integrated Circuits. 3. Use the Dynamic Logic circuits in state-of-the-art VLSI chips. 4. Study critical issues such as ESD protection, Clock distribution, Clock buffering, and Latch phenomenon 5. Use Bipolar and Bi-CMOS circuits in very high speed design. 	
<p>Question Paper Pattern</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book:</p> <ul style="list-style-type: none"> • Sung Mo Kang & Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, Third Edition. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective”, Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000. 2. Wayne, Wolf, “Modern VLSI Design: System on Silicon” Prentice Hall PTR/Pearson Education, Second Edition, 1998. 3. Douglas A Pucknell & Kamran Eshragian, “Basic VLSI Design” PHI 3rd Edition (original Edition – 1994). 	

VLSI & ES Lab-1 [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Laboratory Code	18EVEL16	CIE Marks	40
Number of Lecture Hours/Week	03	SEE marks	60
Total Number of Lecture Hours	01Hr Tutorial (Instructions)+ 03 Hours Laboratory	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This laboratory course enables students to:</p> <ul style="list-style-type: none"> • Learn Verilog Code Programming for the design of digital circuits • Use FPGA/CPLD board and Logic Analyzer or Chipscope to verify the results. • Learn physical design for the digital circuits • Learn Assembly language programming for different applications using ARM- Cortex M3 Kit and Keil uVision- 4 tool. • Learn C language programming for different applications using ARM- Cortex M3 Kit and Keil uVision-4 tool. 			
Experiments			RBT Level
<p>Part – A: VLSI Digital Design Experiments to be done using</p> <ol style="list-style-type: none"> 1. CADENCE/SYNOPSIS/MENTOR GRAPHICS/TANNER or any other equivalent Tool 2. FPGA/CPLD Boards with Xilinx or any other equivalent 			

ASIC-Digital Design Flow

L3

I. Write Verilog Code for the following circuits and their Test Bench for verification, observe the wave technological library (constraints to be given). Do the initial timing verification with gate level simulation.

1. An inverter, Buffer, Transmission gate and basic gates
2. Flip flop - RS, D, JK, MS, T
3. 4-bit counter [Synchronous & Asynchronous counter]

Note: For the set of experiments listed above, students can make the following flow as a study:

- Core Constrained flow
- Creation of I/O pad frame
- Use the created I/O pad frame for Pad constrained design.
- CTS flow Only for designs which have clock

FPGA DIGITAL DESIGN***VLSI Front End Design programs:***

Programming can be done using any compiler. Down load the programs on FPGA/CPLD boards and use pattern generator (32 channels and logic analyzer)/Chipscope pro apart from verification by simulation

1. Write Verilog code for the design of 8-bit
 - i. Carry Ripple Adder
 - ii. Carry Look Ahead adder
 - iii. Carry Skip Adder
2. Write Verilog Code for 8-bit
 - i. Array Multiplication (Signed and Unsigned)
 - ii. Booth Multiplication (Radix-4)
3. Write Verilog code for 4/8-bit
 - i. Magnitude Comparator
 - ii. LFSR
 - iii. Parity Generator
 - iv. Universal Shift Register
4. Design a Mealy and Moore Sequence Detector using Verilog to detect Sequence. Eg 11101 (with and without overlap) any sequence can be specified.

Part – B: Experiments to be done using ARM Cortex M3	
<p>ARM Cortex M3 Programs - Programming to be done using Keil uVision 4 and download the program on to a M3 evaluation board such as NXP LPC1768 or ATMEL ARM</p> <p>a) Write an Assembly language program to calculate the sum and display the result for the addition of first ten numbers. SUM = 10+9+8++1</p> <p>b) Write an Assembly language program to store data in RAM</p> <p>c) Write a C program to output the “Hello World” message using UART</p> <p>d) Write a C program to operate a buzzer using Cortex M3</p> <p>e) Write a C program to display the temperature sensed using Cortex M3.</p> <p>f) Write a C program to control stepper motor using Cortex M3.</p>	L1, L2, L3
<p>Course outcomes: This laboratory course enable the students to:</p> <ol style="list-style-type: none"> 1. Understand the features of CAD tool in VLSI design. 2. Design and verify the behavior of digital circuits using digital flow 3. Verify the design using a logic analyzer 4. Analyse physical design 5. Develop Assembly language programs for different applications using ARM- Cortex M3 Kit and Keil uVision-4 tool. 6. Develop C language programs for different applications using ARM- Cortex M3 Kit and Keil uVision-4 tool. 	
<p>Conduct of Practical Examination:</p> <ul style="list-style-type: none"> • All laboratory experiments are to be included for practical examination. • For examination, one experiment from Part-A and One experiment from Part-B is to be set. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script for breakup of marks. • Change of experiment is allowed only once and Marks allotted to the Procedure part to be made zero. 	

RESEARCH METHODOLOGY AND IPR [As per Choice Based Credit System (CBCS) scheme] SEMESTER -I			
Course Code	18RMI17	CIE Marks	40
Number of Lecture Hours/Week	02	Exam Hours	03
Total Number of Lecture Hours	25	SEE Marks	60
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview of the research methodology and explain the technique of defining a research problem • To explain the functions of the literature review in research. • To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review. • To explain various research designs and their characteristics. • To explain the details of sampling designs, and also different methods of data collections. • To explain the art of interpretation and the art of writing research reports. • To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment. • To discuss leading International Instruments concerning Intellectual Property Rights. ■ 			
Module-1			Teaching Hours/ RBT Level
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. ■			05 L1, L2
Module-2			
Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. ■			05 L1, L2
Module-3			

<p>Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.</p> <p>Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. ■</p>	<p>05</p> <p>L1, L2</p>
<p>Module-4</p>	
<p>Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.</p> <p>Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout.</p> <p>Interpretation and Report Writing (continued): of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. ■</p>	<p>05</p> <p>L1, L2, L3, L4</p>
<p>Module-5</p>	
<p>Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ■</p>	<p>05</p> <p>L1, L2, L3, L4</p>

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Explain the art of interpretation and the art of writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■

Question paper pattern:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

M.Tech-VLSI & ES-2018-SECOND SEMESTER SYLLABUS

DESIGN OF ANALOG AND MIXED MODE VLSI CIRCUITS [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	18EVE21	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Describe basic physics and operation of MOS devices. • Exemplify single-stage and differential amplifiers and current mirrors • Describe operational amplifiers • Learn the design of phase-locked-loops • Know the role of Data converters in an ever-increasing digital world. 			
Modules			RBT Level
Module 1			
Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models.			L1, L2
Single stage Amplifier: Basic Concepts, Common Source stage (Text 1)			
Module 2			
Single stage Amplifier: Source follower, common-gate stage, Cascode Stage, choice of device models.			L1,L2
Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common mode response, Differential pair with MOS loads, Gilbert cell (Text 1)			
Module 3			
Passive and Active Current Mirrors: Basic current mirrors, Cascode Current mirrors, Active Current mirrors.			L1,L2,L3
Operational Amplifiers (part-1): General Considerations, One Stage OP-Amp, Two Stage OP-Amp, Gain boosting (Text 1)			
Module 4			
Operational Amplifiers (part-2): Common Mode Feedback, Slew rate, Power Supply Rejection.			L1,L2,L3
Phase Locked Loops: Simple PLL, Charge pump PLLs, Non-ideal effects in PLLs, Delay-Locked Loops, Applications (Text 1)			
Module 5			
Data Converter Architectures: DAC & ADC Specifications, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC (Text 2)			L1,L2,L3

<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Use efficient analytical tools for quantifying the behaviour of basic circuits by inspection. 2. Design high-performance, stable operational amplifiers with the trade-offs between speed, precision and power dissipation. 3. Design and study the behaviour of phase-locked-loops for the applications. 4. Identify the critical parameters that affect the analog and mixed-signal VLSI circuits' performance 5. Perform calculations in the digital or discrete time domain, more sophisticated data converters to translate the digital data to and from inherently analog world. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH, 2007. 2. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", Second Edition, Wiley. 	
<p>Reference Book:</p> <ul style="list-style-type: none"> • Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford University Press. 	

REAL TIME OPERATING SYSTEM [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	18EVE22	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable the students to:			
<ul style="list-style-type: none"> • Introduce the fundamental concepts of Real Time Operating Systems and the real time embedded system • Apply concepts relating to operating systems such as Scheduling techniques, Thread Safe Reentrant Functions, Dynamic priority policies. • Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real-time services. • Discuss Memory management concepts, Embedded system components, Debugging components and file system components. • Study programs for multithreaded applications using suitable data structures. 			
Modules			RBT Level
Module 1			
Real-Time Systems and Resources: Brief history of Real Time Systems, A brief history of Embedded Systems. System Resources, Resource Analysis, Real-Time Service Utility, Scheduler concepts, Real-Time OS, State transition diagram and tables, Thread Safe Reentrant Functions. (Text 1: Selected sections from Chap. 1, 2)			L1,L2,L3
Module 2			
Processing with Real Time Scheduling: Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies with timing diagrams and problems and issues, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline –Monotonic Policy, Dynamic priority policies, Alternative to RM policy. (Text 1: Chap. 2,3,7)			L1,L2,L3
Module 3			
Memory and I/O: Worst case execution time, Intermediate I/O, Shared Memory, ECC Memory, Flash file systems. Multi-resource Services, Blocking, Deadlock and live lock, Critical sections to protect shared resources, Missed deadline, QoS, Reliability and Availability, Similarities and differences, Reliable software, Available software. (Text 1: Selected topics from Chap. 4,5,6,7,11)			L1,L2,L3
Module 4			
Firmware Components: The 3 firmware components, RTOS system software mechanisms, Software application components. Debugging Components, Exceptions, assert, Checking return codes, Single-step debugging, Test access ports, Trace Ports. (Text 1: Selected topics			L1,L2,L3

from Chap. 8,9)	
Module 5	
Process and Threads: Process and thread creations, Programs related to semaphores, message queue, shared buffer applications involving inter task/thread communication (Text 2: Chap. 11)	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Develop programs for real time services, firmware and RTOS, using the fundamentals of Real Time Embedded System, real time service utilities, debugging methodologies and optimization techniques. 2. Select the appropriate system resources (CPU, I/O, Memory, Cache, ECC Memory, Microcontroller/FPGA/ASIC) to improve the system performance. 3. Apply priority based static and dynamic real time scheduling techniques for the given specifications. 4. Analyze deadlock conditions, shared memory problem, critical section problem, missed deadlines, availability, reliability and QoS. 5. Develop programs for multithreaded applications using suitable techniques and data structure 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sam Siewert, "Real-Time Embedded Systems and Components", Cengage Learning India Edition, 2007. 2. Dr. K.V.K.K Prasad, Embedded/Real Time Systems, Concepts, Design and Programming, Black Book, Dream Tech Press, New edition, 2010. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. James W S Liu, "Real Time System", Pearson education, 2008. 2. Dream Tech Software Team, "Programming for Embedded Systems", John Wiley, India Pvt. Ltd., 2008. 	

SYSTEM VERILOG [As per Choice Based credit System (CBCS) Scheme] SEMESTER – II			
Subject Code	18EVE23	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Understand digital system verification using object oriented methods • Learn the System Verilog language for digital system verification. • Create/build test benches for the basic design/methodology. • Use constrained random tests for verification • Understand concepts of functional coverage 			
Modules			RBT Level
Module 1			
Verification Guidelines: The verification process, basic test bench functionality, directed testing, methodology basics, constrained random stimulus, randomization, functional coverage, test bench components, layered testbench. Data Types: Built in Data types, fixed and dynamic arrays, Queues, associative arrays, linked lists, array methods, choosing a storage type, creating new types with type def, creating user defined structures, type conversion, Enumerated types, constants and strings, Expression width.			L1, L2
Module 2			
Procedural Statements and Routines: Procedural statements, Tasks, Functions and void functions, Task and function overview, Routine arguments, returning from a routine, Local data storage, time values. Converting the test bench and design: Separating the test bench and design, The interface construct, Stimulus timing, Interface driving and sampling, System Verilog assertions.			L1,L2,L3
Module 3			
Randomization: Introduction, Randomization in System Verilog, Constraint details, Solution probabilities, Valid constraints, In-line constraints, Random number functions, Common randomization problems, Iterative and array constraints, Random control, Random Number Generators.			L1,L2,L3
Module 4			
Threads and Interprocess Communication: Working with threads, Disabling threads, Interprocess communication, Events, semaphores, Mailboxes, Building a test bench with threads and Interprocess Communication.			L1,L2,L3

Module 5	
<p>Functional Coverage: Coverage types, Coverage strategies, Simple coverage example, Anatomy of Cover group and Triggering a Cover group, Data sampling, Cross coverage, Generic Cover groups, Coverage options, Analyzing coverage data, measuring coverage statistics during simulation.</p>	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Write test benches for moderately complex digital circuits 2. Use System Verilog language 3. Appreciate functional coverage 4. Apply constrained random tests benches using System Verilog 5. Analyze a verification case and apply System Verilog to verify the design 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book:</p> <ul style="list-style-type: none"> • Chris Spear, 'System Verilog for Verification – A guide to learning the Test bench language features', Springer Publications, 2nd Edition, 2010. 	
<p>Reference Book:</p> <ul style="list-style-type: none"> • Stuart Sutherland, Simon Davidmann, Peter Flake, "System Verilog for Design- A guide to using system verilog for Hardware design and modeling", Springer Publications, 2nd Edition, 2006. • Stuart Sutherland, Simon Davidmann, Peter Flake, System Verilog for Design Second Edition: A Guide to Using System Verilog for Hardware Design and Modeling, Springer Science & Business Media, 15-Sep-2006 	

ADVANCES IN VLSI DESIGN			
[As per Choice Based credit System (CBCS) Scheme]			
SEMESTER – II			
Subject Code	18EVE241	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
<p>Course Objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Learn circuit-oriented approach towards digital design • Illustrate the impact of interconnect wiring on the functionality and performance of a digital gate. • Infer different approaches to digital timing and clocking circuits • Understand the impact of clock skew on the behaviour of digital synchronous circuits. • Explain the role of peripheral circuitry such as the decoders, sense amplifiers, drivers and control circuitry in the design of reliable and fast memories . 			
Modules			RBT Level
Module 1			
<p>Implementation Strategies For Digital ICS: Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology, Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays, Perspective-The Implementation Platform of the Future.</p>			L1,L2,L3
Module 2			
<p>Coping With Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability-Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability-Ohmic Voltage Drop, Electromigration, Resistance and Performance-RC Delay, Inductive Parasitics, Inductance and Reliability-Voltage Drop, Inductance and Performance-Transmission Line Effects, Advanced Interconnect Techniques, Reduced-Swing Circuits, Current-Mode Transmission Techniques, Perspective: Networks-on-a-Chip.</p>			L1,L2,L3
Module 3			
<p>Timing Issues In Digital Circuits: Introduction, Timing Classification of Digital Systems, Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Latch-Base Technique,</p>			L1,L2,L3

Completion-Signal Generation, Self-Timed Signaling, Practical Examples of Self-Timed Logic, Synchronizers and Arbiters, Synchronizers-Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL. d Clocking, Self Timed Circuit Design, Self-Timed Logic - An Asynchronous	
Module 4	
Design of testable sequential circuits: Controllability and observability, Ad-Hoc design rules for improving testability, design of diagnosable sequential circuits, the scan-path technique for testable sequential circuit design, Level Sensitive Scan Design(LSSD), Random Access Scan Technique, Partial scan, testable sequential circuit design using Nonscan Techniques, Cross check, Boundary Scan. (Text 1)	L1,L2,L3
Module 5	
Designing Memory and Array Structures: Memory Reliability and Yield, Signal-to-Noise Ratio, Memory yield, Power Dissipation in Memories, Sources of Power Dissipation in Memories, Partitioning of the memory, Addressing the Active Power Dissipation, Data retention dissipation, Case Studies in Memory Design: The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory, Perspective: Semiconductor Memory Trends and Evolutions.	L1,L2,L3
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Apply design automation for complex circuits using the different implementation methodology like custom versus semi-custom, hardwired versus fixed, regular array versus ad-hoc. 2. Use the approaches to minimize the impact of interconnect parasitics on performance, power dissipation and circuit reliability 3. Impose the ordering of the switching events to meet the desired timing constraints using synchronous, clocked approach. 4. Infer the reliability of the memory 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ul style="list-style-type: none"> • Jan M Rabey, Anantha Chandrakasan, Borivoje Nikolic, –Digital Integrated Circuits-A Design Perspective, PHI, 2nd Edition. 	

SoC DESIGN [As per Choice Based credit System (CBCS) Scheme SEMESTER – II			
Subject Code	18EVE252	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to: <ul style="list-style-type: none"> • Describe the ARM processor architecture and user-level assembly language programming • Appreciate what a high-level language (in this case, C) really needs and how those needs are met by the ARM instruction set. • raises the issues involved in debugging systems which use embedded processor cores and in the production testing of board-level systems. • Learn the concept of memory hierarchy, discussing the principles of memory management and caches. 			
Modules			RBT Level
Module 1			
ARM Organization and Implementation: 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface. The ARM Instruction Set : Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL),Branch, Branch with Link and eXchange (BX, BLX),Software Interrupt (SWI),Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instruction, Half-word and signed byte data transfer instructions,Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions, Coprocessor instructions, Coprocessor data operations, Coprocessor data transfers, Coprocessor register transfers, Breakpoint instruction (BRK - architecture v5T only), Unused instruction space, Memory faults, ARM architecture variants.			L1,L2
Module 2			
Architectural Support for High-Level Languages: Abstraction in software design, Data types, Floating-point data types, The ARM floating-point architecture, Expressions, Conditional statements, Loops, Functions and procedures, Use of memory, Run-time environment. Architectural Support for System Development: The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA), The ARM reference peripheral specification, Hardware			L1,L2

system prototyping tools, The ARMulator, The JTAG boundary scan test architecture, The ARM debug architecture, Embedded Trace, Signal processing support.	
Module 3	
ARM Processor Cores: ARM7TDMI, ARM8,ARM9TDMI, ARM10TDMI,Discussion,Example and exercises. Memory Hierarchy: Memory size and speed, On-chip memory, Caches, Cache design - an example, Memory management, Examples and exercises.	L1,L2
Module 4	
Architectural Support for Operating Systems: An introduction to operating systems, The ARM system control coprocessor, CP15 protection unit registers, ARM protection unit,CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/ Output, Example and exercises. ARM CPU Cores: The ARM710T, ARM720T and ARM740T, The ARM810, The Strong ARM SA-110, The ARM920T and ARM940T, The ARM946E-S and ARM966E-S, The ARM1020E, Discussion, Example and exercises.	L1,L2
Module 5	
Embedded ARM Applications: The VLSI Ruby II Advanced Communication Processor, The VLSI ISDN Subscriber Processor, The One C TM VWS22100 GSM chip, The Ericsson-VLSI Bluetooth Baseband Controller, The ARM7500 and ARM7500FE, The ARM7100 364, The SA-1100 368, Examples and exercises. The AMULET Asynchronous ARM Processors: Self-timed design 375, AMULET1 377, AMULET2 381, AMULET2e 384,AMULET3 387, The DRACO telecommunications controller 390, A self-timed future? 396, Example and exercises.	L1,L2,L3
Course Outcomes: After studying this course, students will be able to: 1. Apply the 3- and 5-stage pipeline ARM processor cores and analyse the implementation issues. 2. Use the concepts and methodologies employed in designing a System- on-chip (SoC) based around a microprocessor core and in designing the microprocessor core itself. 3. Understand how SoCs and microprocessors are designed and used, and why a modern processor is designed the way that it is. 4. Use integrated ARM CPU cores (including StrongARM) that incorporate full support for memory management. 5. Analyze the requirements of a modern operating system and use the ARM architecture to address the same.	
Question paper pattern: <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	

Text Book:

- Steve Furber, “ARM System-On-Chip Architecture”, Addison Wesley, 2nd edition.

References Books:

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, 2nd edn, Newnes, (Elsevier), 2010.
2. Sudeep Pasricha and Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufmann, Publishers © 2008.
3. Michael Keating, Pierre Bricaud, “Reuse Methodology Manual for System on Chip designs”, Kluwer Accademic Publishers, 2nd edition, 2008.

VLSI & ES Lab-2			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – II			
Laboratory Code	18EVEL26	IA Marks	40
Number of Lecture Hours/Week	01Hr Tutorial (Instructions) + 03 Hours Laboratory	Exam Mark	60
		Exam Hour	03
CREDITS – 02			
Course objectives: This course will enable students to:			
<ul style="list-style-type: none"> • Learn the CAD tool and the flow of the Full Custom IC design cycle. • Learn running DRC, LVS and Parasitic Extraction of the various designs. • Create various components like inverter, differential amplifier and use the same in the design of operational amplifier, R-2R based DAC and ADC. • Understand the suitability of different techniques of IPC and task switching in a multithreaded application. • Study and implement different types of data structures required to implement inter task communication. • Implement Inter task communication using an appropriate data structure. 			
Experiments			(RBT) Level
<p>PART A: VLSI Design. Experiments to be conducted using suitable CAD tool</p> <p>1. Design an Inverter with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) Transient Analysis b. Draw the Layout and verify the DRC, ERC c. Check for XX d. Extract RC and back annotate the same and verify the Design e. Verify & Optimize for Time, Power and Area to the given constraint*** 			L2,L3,L4

<p>2. Design the following circuits with given specifications*, completing the design flow mentioned below:</p> <ol style="list-style-type: none"> a. Draw the schematic and verify the following <ol style="list-style-type: none"> i) DC Analysis ii) AC Analysis iii) Transient Analysis b. Draw the Layout and verify the DRC, ERC, LVS c. Check for XX d. Extract RC and back annotate the same and verify the Design <ol style="list-style-type: none"> i) Single Stage differential amplifier ii) Common source amplifier iii) Design an op-amp with given specification* using differential amplifier Common source amplifier in library** iv) Design a 4 bit R-2R based DAC for the given specification** 	
<p>3. Design an Integrator using OPAMP (First Order)</p>	
<p>4. Design a Differentiator using OPAMP (First Order)</p>	
<p>5. Design and characterize a basic Sigma delta ADC from the available designs.</p>	
<p>PART B: RTOS programs using C language in LINUX OS.</p> <ol style="list-style-type: none"> 1. Develop programs to (a) create child process and display it's id and (b) Execute child process function using switch structure 2. Develop and test program for a multithreaded application, where communication is through a buffer for the conversion of lowercase text to uppercase text, using semaphore concept. 3. Develop and test program for a multithreaded application, where communication is through shared memory for the conversion of lowercase text to uppercase text. 4. Develop program for inter-thread communication using message queue. Data is to be input from the keyboard for the chosen application 5. Create 'n' number of child threads. Each thread prints the message "I'm in thread number ..." and sleeps for 50 ms and then quits. The main thread waits for complete execution of all the child threads and then quits. Compile and execute in Linux. 6. Implement the usage of anonymous pipe with 512 bytes for data sharing between parent and child processes using handle inheritance mechanism 	<p>L1, L2, L3</p>

Course outcomes: On the completion of this laboratory course, the students will be able to:

- Design, implement and analyse analog, digital and mixed mode circuits
- Learn the various issues in Mixed signal designs basically data converters.
- Acquire hands-on skills of using CAD tools in VLSI design.
- Appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system.
- Select a suitable task switching technique in a multithreaded application.
- Implement different techniques of message passing and Inter task communication.
- Implement different data structures such as pipes, queues and buffers in multithreaded programming.

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- For examination, two questions using different tool to be set.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero.

M.Tech-VLSI & ES-2018- THIRD SEMESTER SYLLABUS

CAD of DIGITAL SYSTEMS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – III			
Course Code	18EVE31	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits –03			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Use graph theory in physical design • Learn various optimization methods • Understand different techniques for placement and routing 			
Modules			RBT Levels
Module-1			
<p>Introduction to Design Methodologies: The VLSI Design Problem, The Design Domains, Design Actions, Design Methods and Technologies.</p> <p>VLSI Design Automation tools: Algorithmic and System Design, Structural and Logic Design, Transistor-level Design, Layout Design, Verification Methods, Design Management Tools.</p> <p>Algorithmic graph theory and computational complexity: Terminology, Data Structures for the Representation of Graphs, Computational Complexity, Examples of Graph Algorithms.</p> <p>Tractable and intractable problems: Decision Problems, Complexity Classes, NP-completeness and NP-hardness, Consequences.</p>			L1, L2
Module-2			
<p>General purpose methods for combinational optimization: Backtracking and Branch-and-bound, Dynamic Programming, Integer Linear Programming, Local Search, Simulated Annealing, Tabu Search, Genetic Algorithms, A Few Final Remarks on General-purpose Methods.</p> <p>Layout compaction: Design Rules, Symbolic Layout, Problem Formulation, Algorithms for Constraint-graph Compaction, Other Issues.</p>			L2,L3
Module-3			
<p>Placement and partitioning: Circuit Representation, Wire-length Estimation, Types of Placement Problem, Placement Algorithm, Partitioning.</p> <p>Floor planning: Floorplanning Concepts, Shape Functions and Floorplan Sizing.</p>			L2,L3
Module-4			

<p>Routing: Types of Local Routing Problems, Area Routing, Channel Routing, Introduction to Global Routing, Algorithms for Global Routing.</p> <p>Simulation: General Remarks on VLSI Simulation, Gate-level Modeling and Simulation, Switch-level Modeling and Simulation.</p>	L2,L3
Module-5	
<p>Logic Synthesis and Verification: Introduction to Combinational Logic Synthesis, Binary-decision Diagrams, Two-level Logic Synthesis</p> <p>High level synthesis: Hardware Models for High Level Synthesis, Internal Representation of the Input Algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithm, Some Aspects of the Assignment Problem, High-level Transformations.</p>	L3,L4
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Solve graph theoretic problems. 2. Evaluate the computational complexity of an algorithm 3. Write algorithms for VLSI Automation 4. Simulate and synthesize digital circuits using VLSI automation tools. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Book:</p> <ul style="list-style-type: none"> • S H Gerez, “ Algorithms for VLSI Design Automation”, Wiley, India, 2nd edition 	
<p>Reference Books:</p> <ul style="list-style-type: none"> • N.A. Sherwani, “Algorithms for VLSI Physical Design Automation”. Springer International edition, 3rd edition. 	

ADVANCES IN IMAGE PROCESSING [As per Choice Based credit System (CBCS) Scheme SEMESTER – III]			
Subject Code	18ECS321	CIE Marks	40
Number of Lecture Hours/Week	04	SEE marks	60
Total Number of Lecture Hours	50 (10 Hours Per Module)	Exam Hours	03
CREDITS – 04			
Course Objectives: This course will enable students to:			
<ol style="list-style-type: none"> 1. Acquire fundamental knowledge in understanding the representation of the digital image and its properties 2. Equip with some pre-processing techniques required to enhance the image for further analysis purpose. 3. Select the region of interest in the image using segmentation techniques. 4. Represent the image based on its shape and edge information. 5. Describe the objects present in the image based on its properties and structure. 			
Modules			RBT Level
Module 1			
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.			L1
Module 2			
Image Pre-processing: Pixel brightness transformations, geometric transformations, local pre-processing.			L1, L2
Module 3			
Segmentation: Thresholding; Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging, Watershed segmentation, Region growing post-processing.			L1, L2, L3
Module 4			
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, B-spline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.			L1, L2, L3
Module 5			
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and			L1, L2, L3

watersheds.	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the representation of the digital image and its properties • Apply pre-processing techniques required to enhance the image for its further analysis. • Use segmentation techniques to select the region of interest in the image for analysis • Represent the image based on its shape and edge information. • Describe the objects present in the image based on its properties and structure. • Use morphological operations to simplify images, and quantify and preserve the main shape characteristics of the objects. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, Cengage Learning, 2013, ISBN: 978-81-315-1883-0 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge university Press, 2010 2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, 2011. 	

INTERNET of THINGS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Course Code	18ECS333	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50 (10 Hours per Module)	Exam Hours	03
Credits – 04			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • Introduce concept of IOT and its applications in today’s scenario. • Understand IOT content generation and transport through networks • Understand the devices employed for IOT data acquisition and communication access technologies • Introduce some use cases of IOT 			
Module-1			RBT
<p>What is IOT Genesis, Digitization, Impact, Connected Roadways, Buildings, Challenges</p> <p>IOT Network Architecture and Design Drivers behind new network Architectures, Comparing IOT Architectures, M2M architecture, IOT world forum standard, IOT Reference Model, Simplified IOT Architecture.</p>			L1, L2
Module-2			
<p>IOT Network Architecture and Design Core IOT Functional Stack, Layer1(Sensors and Actuators), Layer 2(Communications Sublayer), Access network sublayer, Gateways and backhaul sublayer, Network transport sublayer, IOT Network management. Layer 3(Applications and Analytics) – Analytics vs Control, Data vs Network Analytics IOT Data Management and Compute Stack</p>			L2,L3
Module-3			
<p>Engineering IOT Networks Things in IOT – Sensors, Actuators, MEMS and smart objects. Sensor networks, WSN, Communication protocols for WSN Communications Criteria, Range Frequency bands, power consumption, Topology, Constrained Devices, Constrained Node Networks IOT Access Technologies, IEEE 802.15.4 Competitive Technologies – Overview only of IEEE 802.15.4g, 4e, IEEE 1901.2a Standard Alliances – LTE Cat0, Cat-M, NB-IOT</p>			L2,L3
Module-4			

<p>Engineering IOT Networks IP as IOT network layer, Key Advantages, Adoption, Optimization, Constrained Nodes, Constrained Networks, IP versions, Optimizing IP for IOT. Application Protocols for IOT – Transport Layer, Application Transport layer, Background only of SCADA, Generic web based protocols, IOT Application Layer Data and Analytics for IOT – Introduction, Structured and Unstructured data, IOT Data Analytics overview and Challenges.</p>	L3,L4
Module-5	
<p>IOT in Industry (Three Use cases) IOT Strategy for Connected manufacturing, Architecture for Connected Factory Utilities – Power utility, IT/OT divide, Grid blocks reference model, Reference Architecture, Primary substation grid block and automation. Smart and Connected cities –Strategy, Smart city network Architecture, Street layer, city layer, Data center layer, services layer, Smart city security architecture, Smart street lighting.</p>	L3,L4
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Course Outcomes: After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand the basic concepts IOT Architecture and devices employed. 2. Analyze the sensor data generated and map it to IOT protocol stack for transport. 3. Apply communications knowledge to facilitate transport of IOT data over various available communications media. 4. Design a use case for a typical application in real life ranging from sensing devices to analyzing the data available on a server to perform tasks on the device. 	
<p>Text Book:</p> <ul style="list-style-type: none"> • CISCO, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017). ISBN-10: 9386873745, ISBN-13: 978-9386873743 	
<p>Reference Book:</p> <ul style="list-style-type: none"> • Arshdeep Bahga and Vijay Madiseti, ‘Internet of Things – A Hands on Approach’, Orient Blackswan Private Limited - New Delhi; First edition (2015), ISBN-10: 8173719543, ISBN-13: 978-8173719547 	

M.TECH. POWER ELECTRONICS (EPE)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. POWER ELECTRONICS (EPE)
(2014-16)

I Semester

Credit Based

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam		
14MAT11	Applied Mathematics	4	2	3	50	100	150	4
14 EPE 12	Power Semiconductor Devices	4	2	3	50	100	150	4
14 EPE 13	Modeling and Simulation of Power Electronic Systems	4	2	3	50	100	150	4
14 EPE 14	Solid State Power Controllers	4	2	3	50	100	150	4
14 EPE 15X	Elective-I	4	2	3	50	100	150	4
14 EPE 16	Power Electronics Laboratory - I	--	3	3	25	50	75	2
14 EPE 17	Seminar	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective – I

Subject Code	Name of the Subject
14EPE151	Embedded System Design
14EPE152	Soft Computing
14EPE153	Advanced Control Systems

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II Semester

Credit Based

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical / Field Work / Assignment/ Tutorials		IA	Exam		
14EPE21	AC and DC Drives	4	2	3	50	100	150	4
14 EPE 22	Switched Mode Power Conversion	4	2	3	50	100	150	4
14 EPE 23	Power Electronics System Design using ICs	4	2	3	50	100	150	4
14 EPE24	FACTS Controllers	4	2	3	50	100	150	4
14 EPE 25X	Elective-II	4	2	3	50	100	150	4
14 EPE 26	Power Electronics Laboratory - II		3	3	25	50	75	2
14 EPE 27	Seminar	--	3	--	25	--	25	1
	**Project Phase-I (6 week Duration)	--	--	--	--	--	--	--
Total		20	16	18	300	550	850	23

**** Between the II Semester and III Semester, after availing a vacation of 2 weeks.**

Elective – II

Subject Code	Name of the Subject
14EPE251	Real Time Digital Signal Processing
14EPE252	Modeling and Analysis of Electrical Machines
14EPE253	Electro Magnetic Compatibility

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(2014-16)

III Semester: INTERNSHIP					Credit Based			
Course Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical/Field Work		IA	Exam		
14EPE31	Seminar/Presentation on Internship (After 8 weeks from the date of commencement)	--	--	--	25	--	25	1
14EPE32	Report on Internship	--	--	--	--	75	75	15
14EPE33	Evaluation and Viva-Voce	--	--	--	--	50	50	4
Total		--	--	--	25	125	150	20

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(2014-16)

IV Semester

Credit Based

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Field Work / Assignment / Tutorials		IA	Exam		
14EPE41	HVDC power Transmission	4	--	3	50	100	150	4
14EPE 42X	Elective-III	4	--	3	50	100	150	4
14EPE43	Evaluation of Project Phase – II	--	--	--	25	--	25	1
14EPE44	Evaluation of Project work – III	--	--	--	25	--	25	1
14EPE45	Evaluation of Project Work and Viva-voce	--	--	3	--	100+100	200	18
	Total	8	--	09	50	400	550	28

Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits

Elective - III

Subject code	Name of the Subject
14EPE421	Power Quality Enhancement using Custom Power Devices
14EPE422	PWM Converters and Applications
14EPE423	DSP Applications to Drives

Note:

- 1) Project Phase – I:6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation.
- 2) Project Phase – II:16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 25.
- 3) Project Phase – III :24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. At the end of the semester Project Work evaluation and Viva-Voce Examinations shall be conducted.

Total Marks shall be 250 (Phase - II Evaluation: 25 Marks, Phase – III Evaluation:25 Marks, Project Evaluation marks by Internal Examiner (Guide):50, Project Evaluation marks by External Examiner :50, Viva-Voce Examination:100 Marks).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university (Out of two external examiners at least one should be present).

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
APPLIED MATHEMATICS			
Subject Code	14MAT11	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Numerical Methods: Solution of algebraic and transcendental equations- iterative methods based on second degree equation – Muller method,(no derivation) Chebyshev method, general iteration method (first order),acceleration of convergence, system of non-linear equations, and complex roots – Newton-Raphson method, polynomial equations – Birge –Vieta method and Bairstow’s method.

Numerical Solution of Partial Differential Equations: Classification of second order equations, parabolic equations- solution of one dimensional heat equation, explicit method,Crank-Nicolson method and Du Fort-Frankel method, hyperbolic equations- solution of one dimensional wave equation.

System of Linear Algebraic Equations and Eigen Value Problems: Iterative methods - Gauss-Seidal method, SOR method, Eigen value problems – Gerschgorian circle, Eigen values and Eigen vectors of real symmetric matrices - Jacobi method, Givens method.

Interpolation:Hermite interpolation, spline interpolation, numerical solution of differential equations – Numerov method.

Optimization: Linear programming- formulation of the problem, graphical method, general linear programming problem, simplex method, artificial variable technique -M-method.

Graph Theory: Basic terminologies, types of graphs, sub graphs, graphs isomorphism, connected graphs-walks, paths, circuits, connected and disconnected graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, applications of graphs.

Linear Algebra: Vector spaces, linear dependent, independence, basis and dimension, elementary properties, examples.

Linear Transformations: Definition, properties, range and null space, rank and nullity, algebra of linear transformations- invertible, singular and non-singular transformations, representation of transformations by matrices.

REFERENCE BOOKS

1. M K Jain, S R K Iyengar and R K Jain, “Numerical Methods for Scientific and Engineering Computations”, New Age International, 2004.
2. M K Jain, “Numerical Solution of Differential Equations”, 2ndEdition, New Age International, 2008.
3. Dr. B.S. Grewal, “Numerical Methods in Engineering and Science”, Khanna Publishers, 1999.
4. Dr. B.S. Grewal, “Higher Engineering Mathematics”, 41stEdition, Khanna Publishers, 2011.
5. NarsinghDeo, “Graph Theory with Applications to Engineering and Computer Science”, PHI, 2012.
6. Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2ndEdition, PHI, 2011.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
POWER SEMICONDUCTOR DEVICES			
Subject Code	14EPE12	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Power Diodes: Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristics-turn-on transient, turn-off transient and reverse recovery transient, Schottky diodes, snubber requirements for diodes, diode snubber, modeling and simulation of power diodes.

Thyristors:- Basic structure, V-I characteristics, turn-on process, on-state operation, turn -off process, switching characteristics, turn-on transient and di/dt limitations, turn-off transient, turn-off time and reapplied dv/dt limitations, gate drive requirements, ratings of thyristors, snubber requirements and snubber design, modeling and simulation of thyristors.

Triacs: Basic structure and operation-I characteristics, ratings, snubber requirements, modeling and simulation of triacs.

Gate Turnoff Thyristor (GTO): Basic structure and operation, GTO switching characteristics, GTO turn-on transient, GTO turn -off transient, minimum on and off state times, gate drive requirements, maximum controllable anode current, overcurrent protection of GTO'S, modelling and simulation of GTO'S.

Power BJT'S: Basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and it's control- FBSOA and RBSOA curves - on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turn-on transient, turn-off transient, storage time, base drive requirements, switching losses, device protection- snubber requirements for BJT'S and snubber design - switching aids, modeling and simulation of power BJT'S.

Power MOSFET'S:- Basic structure, V-I characteristics, turn-on process, on state operation, turn-off process, switching characteristics, resistive switching specifications, clamped inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses - dv/dt limitations, gating requirements, gate charge - ratings of MOSFET'S, FBSOA and RBSOA curves, device protection -snubber requirements, modeling and simulation of Power MOSFET'S.

Insulated Gate Bipolar Transistors (IGBT'S): Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specifications - IGBT turn-on transient, IGBT turn off transient- current tailing - gating requirements -ratings of IGBT'S, FBSOA and RBSOA curves, switching losses - minimum on and off state times - switching frequency capability - overcurrent protection of IGBT'S, short circuit protection, snubber requirements and snubber design.

New Power Semiconductor Devices : MOS gated thyristors, MOS controlled thyristors or MOS GTO'S, base resistance controlled thyristors, emitter switched thyristor, thermal design of power electronic equipment, modeling and simulation, heat transfer by conduction, transient thermal impedance - heat sinks, heat transfer by radiation and convection - heat sink selection for power semiconductor devices.

REFERENCE BOOKS

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rdEdition. Wiley India Pvt Ltd, 2011.
2. G. Massobrio, P. Antognetti, "Semiconductor Device Modeling with Spice", McGraw-Hill, 2nd Edition, 2010.
3. B. JayantBaliga, "Power Semiconductor Devices", 1stEdition, International Thompson Computer Press, 1995.
4. V. Benda, J. Gowar, and D. A. Grant, "Discrete and Integrated Power Semiconductor Devices: Theory and Applications", John Wiley & Sons, 1999.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
MODELING AND SIMULATION OF POWER ELECTRONIC SYSTEMS			
Subject Code	14EPE13	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Computer Simulation of Power Electronic Converters and Systems: Challenges in computer simulation, simulation process, Types of analysis, mechanics of simulation, circuit-oriented simulators, equation solvers, comparison of circuit oriented simulators and equation solvers.

Modeling of Systems: Input-Output relations, differential equations and linearization, state space representation, transfer function representation, modeling of an armature controlled DC Motor, poles and zeros circuit averaging method of modelling approach for switched power electronic circuits, space vector modeling, space vectors, representation of space vectors in orthogonal co-ordinates, space vector transformations, modeling of induction motor, state space representation of the d-q model of the induction motor.

Digital Controller Design: Controller design techniques, Bode diagram method, PID controller, design, root locus method, state space method. Tracker, controller design, controlling voltage, controlling current.

Discrete Computation Essentials: Numeric formats, fixed -point numeric format, floating -point numeric format, tracking the base point in the fixed point system, addition of numbers, subtraction of numbers, multiplication of numbers, normalization and scaling, multiplication algorithm, arithmetic algorithm reciprocal, square root, reciprocal of square root, sine and cosine exponential, logarithm, implementation examples, pi controller, sine and cosine, pulse width modulation, space vector pwm, over-modulation.

REFERENCE BOOKS

- 1 .Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3 rd Edition, John Wiley & Sons, 2009.
2. L.Umanand, "Power Electronics Essentials and Applications", 1st Edition, John Wiley & Sons, 2009.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
SOLID STATE POWER CONTROLLERS			
Subject Code	14EPE14	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Line Commutated Converters: Phase control, single phase semi-converter & fully controlled converter, three phase semi controlled & fully controlled converter, dual converters, power factor improvement methods, effect of source inductance, single phase series converters, twelve pulse converter and design of converter circuits.

Inverters: Principle of operation, performance parameters, single phase bridge inverters and three phase inverters.

Voltage Control of Single Phase Inverters: Single/multiple, pulse/SPWM/ modified SPWM methods, voltage control of three phase inverter, SPWM/third harmonic PWM/Space vector modulation, harmonic reduction, current source inverter, comparison between VSI & CSI.

Multilevel Inverters: Introduction, types, diode clamped multi-level inverters, features & applications.

DC-DC Converters: Principle of operation, analysis of step-down and step-up converters, classification of chopper & chopper circuit design.

REFERENCE BOOKS

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rdEdition, Wiley India Pvt Ltd, 2011
2. Rashid M.H, "Power Electronics: Circuits Devices and Applications", 3rdEdition, Pearson, 2011.
3. B. K. Bose, "Modern Power Electronics & AC Drives", PHI, 2012.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
EMBEDDED SYSTEM DESIGN(ELECTIVE-I)			
Subject Code	14EPE151	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Introduction to Embedded System: An embedded system, processor, hardware unit, software embedded into a system, example of an embedded system, OS services, I/O, N/W, O/S, real time and embedded OS.

Processor and Memory Organization: Structural unit in a processor, processor selection for an embedded systems, memory devices, memory selection for an embedded system, allocation of memory to program statements and blocks and memory map of a system, direct memory accesses.

Real Time System: Types, real time computing, design issues, sample systems, hardware requirements- processor introduction, ARM various system architecture, high performance processors - strong ARM processors, addressing modes, instruction set, basic alp programs, interrupt structure.

Real Time Operating System: Fundamental requirements of RTOS, real time kernel types, schedulers, various scheduling modules with examples, latency (interrupt latency, scheduling latency and context switching latency), tasks, state transition diagram, task control block. Inter-task communication and synchronization of tasks, building real time applications.

REFERENCE BOOKS

1. Rajkamal "Embedded System Architecture: Programming & Design", TMH, 2010.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
3. Philip. A. Laplante, "Real-Time Systems Design and Analysis- An Engineer's Handbook"- 2ndEdition, Pearson.
4. Jane W.S. Liu, "Real-Time Systems", Pearson Education Inc,2012.
5. K.V.K K Prasad, "Embedded Real Time Systems: Concepts Design and Programming", Dreamtech Press New Delhi, 2003

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
POWER ELECTRONICS LABORATORY - I			
Subject Code	14EPE16	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	03
Number of Practical Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	--	Exam Marks	50

1. Analysis of static and dynamic characteristic of MOSFET and IGBT
2. Performance of single phase fully controlled and semi-controlled converter for RL load for continuous current mode
3. Performance of single phase fully controlled and semi-controlled converter for RL load for discontinuous current mode
4. Study of effect of source inductance on the performance of single phase fully controlled converter
5. Performance analysis of three phase fully controlled and semi-controlled converter for RL load for continuous current mode
6. Performance analysis of three phase fully controlled and semi-controlled converter for RL load for discontinuous current mode
7. Performance analysis of single phase bridge inverter for RL load and voltage control by single pulse width modulation
8. Performance analysis of two quadrant chopper
9. Diode clamped multilevel inverter
10. ZVS operation of a Synchronous buck converter

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
SEMINAR			
Subject Code	14EPE17	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contactHours	--	Exam Marks	--

The aim of the seminar is to inculcate self-learning, face audience, enhance communication skill, involve in group discussion and present his ideas.

Each student, under the guidance of a Faculty, is required to

- i) Choose a topic of his/her interest relevant to the Course of Specialization
- ii) Carryout literature survey, organize the subject topics in a systematic order
- iii) Prepare the report with own sentences
- iv) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities
- v) Present the seminar topic at least for 20 minutes orally and/or through power point slides
- vi) Answer the queries and involve in debate/discussion lasting for about 10 minutes
- vii) Submit two copies of the typed report with a list of references

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

The internal assessment marks shall be awarded by a committee consisting of at least two staff members based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
ACANDDC DRIVES			
Subject Code	14EPE21	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Electric Drives: Introduction – block diagram-classification of electrical drives-choice of electrical drives-fundamental torque equation- components of load torque- steady state stability.

DC Drives: Single Quadrant Drive: 1-Phase semi and half wave converter drives, Two quadrant Drive: 1-phase and 3-phase full converter drive.

Two and Four Quadrant drive: 1-phase and three- phase dual converter drive, different braking methods and closed loop control of DC drives.

AC Drives: Voltage and current source inverter - inverter control-six step and PWM operation, Control of Induction motor drive -V/f and field oriented control – direct and indirect vector control, voltage and current source inverter fed induction motor drives, stator and rotor voltage control methods, slip energy recovery drives.

Closed Loop Control of AC Drives: Stator voltage control, V/f control, slip regulation, speed control of static Kramer's drive, current control, brushless DC motor, stepper motor and variable reluctance motor drives static excitation schemes of AC generator.

REFERENCE BOOKS

1. Bose B. K, "Modern Power Electronics & AC Drives" PHI, 2011.
2. Murphy JMD, Turnbull F.G., "Thyristor Control of AC Motors" Pergamon Press Oxford, 1998.
3. R.Krishanan "Electric Motor Drives", EEE, PHI, 2010.
4. MehrdadEhsani, YiminGao, AlinEmadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle Fundamentals, Theory and Design" Special Indian Edition, CRC Press 2011.
5. High Performance Control of AC Drives "Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, Wiley, 2012.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
SWITCHED MODE POWER CONVERSION			
Subject Code	14EPE22	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

DC – DC Converters (Basic Converters): Linear voltage regulators (LVRs), a basic switching converter(SMPC), comparison between LVR & SMPC, principle of operation and analysis of buck converter analysis, inductor current ripple and output voltage ripple, capacitor resistance effect, synchronous rectification, design considerations, buck converter for discontinuous current operation, principle of operation and analysis of boost converter, inductor current ripple and output voltage ripple, inductor resistance effect, design considerations, boost converter for discontinuous current operation, principle of operation and analysis of buck-boost converter analysis, inductors current ripple and output voltage ripple, design considerations, buck-boost converter for discontinuous current operation, principle of operation and analysis of CUK converter , inductor current ripple and output voltage ripple, capacitor resistance effect, design considerations, single ended primary inductance converter(SEPIC).

Derived Converters: Introduction, transformer models, principle of operation and analysis of fly back converter-continuous and discontinuous current mode of operation, design considerations, principle of operation and analysis of forward converter, design considerations, double ended(Two switch) forward converter, principle of operation and analysis of push-pull converter, design considerations, principle of operation and analysis of full bridge and half-bridge DC-DC converters, design considerations, current fed converters, multiple outputs.

Control of DC-DC Converter: Modeling of DC-DC converters, power supply control, control loop stability, small signal analysis, switch transfer function, filter transfer function, PWM transfer function, Type-2 error amplifier with compensation, design, PSpice simulation of feedback control, Type-3 error amplifier with compensation, design.

Resonant Converters: Introduction, resonant switch ZCS converter, principle of operation and analysis, resonant switch ZVS converter, principle of operation and analysis, series resonant inverter, series resonant DC-DC converter, parallel resonant DC-DC converter, series- parallel resonant DC-DC converter, resonant converters comparison, resonant DC link converter.

Design of inductor and transformers for SMPC.

REFERENCE BOOKS

1. Daniel W Hart, "Power Electronics", Tata McGraw Hill, 2011.
2. Rashid M.H., "Power Electronics – Circuits Devices and Applications", 3rd Edition, Pearson, 2011.
3. D M Mitchel, "DC-DC Switching Regulator Analysis" McGraw-Hill Ltd, 1988.
4. Umanand L and Bhatt S R, "Design of Magnetic Components for Switched Mode Power Converters", New Age International, New Delhi, 2001
5. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rd Edition, Wiley India Pvt Ltd, 2010.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
POWER ELECTRONICS SYSTEM DESIGN USING ICS			
Subject Code	14EPE23	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction: Measurement techniques for voltages, current, power, power factor in power electronic circuits, other recording and analysis of waveforms, sensing of speed.

Switching Regulator Control Circuits : Introduction, isolation techniques of switching regulator systems, PWM systems.

Commercial PWM Control ICs and their Applications: TL 494 PWM Control IC, UC 1840 Programmable off line PWM controller, UC 1524 PWM control IC, UC 1846 current mode control IC, UC 1852 resonant mode power supply controller.

Switching Power Supply Ancillary, Supervisory & Peripheral Circuits and Components: Introduction, Opto-couplers, self-biased techniques used in primary side of reference power supplies, Soft/Start in switching power supplies, current limit circuits, over voltage protection, AC line loss detection.

Phase – Locked Loops (PLL) & Applications: PLL Design using ICs, 555 timer & its applications, analog to digital converter using IC's, digital to analog converters using ICs, implementation of different gating circuits.

Programmable Logic Controllers (PLC): Basic configuration of a PLC, Programming and PLC, program modification, power converter control using PLCs.

REFERENCE BOOKS

1. G. K. Dubey, S. R. Doradla, A. Johsi, and R. M. K. Sinha, "Thyristorised Power Controllers", 2nd Edition, New Age International, 2010.
2. Chryssis "High Frequency Switching Power Supplies", 2nd Edition, MGH, 1989.
3. Unitrode application notes: <http://www.smps.us/Unitrode.html>

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
FACTS CONTROLLERS			
Subject Code	14EPE24	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction: Basics of power transmission networks - control of power flow in AC - transmission line- flexible AC transmission system controllers – application of FACTS controllers in distribution systems.

AC Transmission Line and Reactive Power Compensation: Analysis of uncompensated AC Line - passive reactive power compensation - compensation by a series capacitor connected at the midpoint of the line - shunt compensation connected at the midpoint of the line - comparison between series and shunt capacitor - compensation by STATCOM and SSSC - some representative examples.

Static Var Compensator: Analysis of SVC - Configuration of SVC- SVC Controller – voltage regulator design - some issues - harmonics and filtering - protection aspects – modeling of SVC – applications of SVC.

Thyristor and GTO Controlled Series Capacitor: Introduction - basic concepts of controlled series compensation - operation of TCSC - analysis of TCSC- control of TCSC - modeling of TCSC for stability studies - GTO thyristor controlled series capacitor (GCSC) - mitigation of sub synchronous resonance with TCSC and GCSC - applications of TCSC.

Static Phase Shifting Transformer: General - basic principle of a PST - configurations of SPST improvement of transient stability using SPST - damping of low frequency power oscillations - applications of SPST.

Static Synchronous Compensator (STATCOM): Introduction - principle of operation of STATCOM - a simplified analysis of a three phase six pulse STATCOM - analysis of a six pulse VSC using switching functions - multi-pulse converters control of type 2 converters - control of type I Converters - multilevel voltage source converters - harmonic transfer and resonance in VSC, applications of STATCOM.

SSSC and UPFC:

SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow and transient stability. Unified Power Flow Controller (UPFC) – Principle of operation – modes of operation – applications – modeling of UPFC for power flow studies.

Special Purpose FACTS Controllers: Interline Power Flow Controller - operation and control.

REFERENCE BOOKS

1. K.R Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International, 2007.
2. Narain G Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, Wiley India, 2011.
3. Y. H. Song and A. T. Johns, “Flexible AC Transmission System”, Institution of Engineering and Technology, 2009.
4. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
MODELING AND ANALYSIS OF ELECTRICAL MACHINES(ELECTIVE-II)			
Subject Code	14EPE252	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Basic Concepts of Modeling: Basic two pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bar and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations.

DC Machine Modeling: Mathematical model of separately excited DC motor-steady state and transient state analysis, sudden application of inertia load, transfer function of separately excited DC motor, mathematical model of dc series motor, shunt motor, linearization techniques for small perturbations.

Reference Frame Theory: Real time model of a two phase induction machine, transformation to obtain constant matrices, three phase to two phase transformation, power equivalence.

Dynamic Modeling of Three Phase Induction Machine: Generalized model in arbitrary frame, electromagnetic torque, deviation of commonly used induction motor models-stator reference frames model, rotor reference frames model, synchronously rotating reference frames model, equations in flux linkages, per unit model, dynamic simulation.

Small Signal Equations of the Induction Machine: Derivation of small signal equations of induction machine, space phasor model, DQ flux linkages model derivation, control principle of the induction motor.

Transformer Modeling: Introduction, single phase transformer model, three phase transformer connections, per phase analysis, normal systems, per unit normalization, per unit three phase quantities, change of base, per unit analysis of normal system, regulating transformers for voltage and phase angle control, auto transformers, transmission line and transformers.

Modeling of Synchronous Machines: Introduction, voltage equations and torque equation in machine variables, stator voltage equations in arbitrary and rotor reference frame variables, Park's equations, torque equations in substitute variables, rotor angle and angle between rotors, per unit system, analysis of steady state operation.

Dynamic Analysis of Synchronous Machines: Dynamic performance during sudden change in input torque and during a 3-phase fault at the machine terminals, approximate transient torque versus rotor angle characteristics, comparison of actual and approximate transient torque-angle characteristics during a sudden change in input torque; first swing transient stability limit, comparison of actual and approximate transient torque-angle characteristics during a 3-phase fault at the machine terminals, critical clearing time, equal area criterion, computer simulation.

REFERENCE BOOKS

1. P.S.Bimbra, "Generalized Theory of Electrical Machines", 5thEdition, Khanna Publications, 1995.
2. R. Krishnan, "Electric Motor Drives - Modeling, Analysis & Control", PHI Learning Private Ltd, 2009.
3. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drive Systems", 2ndEdition, Wiley(India),2010.
4. Arthur R Bergen and Vijay Vittal, "Power System Analysis", 2nd Edition, Pearson, 2009.
5. PrabhaKundur, "Power System Stability and Control", TMH, 2010.
6. Chee-MunOng, "Dynamic Simulation of Electric Machinery using Matlab / Simulink",Prentice Hall, 1998.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
POWER ELECTRONICSLABORATORY - II			
Subject Code	14EPE26	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	03
Number of Practical Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Practical Hours	--	Exam Marks	50

1. Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for continuous current mode.
2. Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.
3. Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for continuous current mode.
4. Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.
5. Performance analysis of a practical chopper fed DC Drives system for class-A and class-C commutation and analysis of wave forms in continuous mode.
6. Simulation study of buck, boost and buck- boost converter (basic topologies) and analysis of wave forms for continuous current mode (CCM).
7. Simulation study of buck, boost and buck-boost converter (basic topologies) and analysis of wave forms for discontinuous current mode (DCM).
8. Simulation study of forward converter and fly back converter and performance analysis of various wave forms.
9. Resonant converter simulation study and analysis
10. Closed loop operation of a buck and boost converter.

**M.TECH. POWER ELECTRONICS (EPE)
SEMESTER - II**

SEMINAR

Subject Code	14EPE27	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Hours	--	Exam Marks	--

M.TECH. POWER ELECTRONICS (EPE)					
SEMESTER - III					
INTERNSHIP					
Subject Code	14EPE31	IA Marks	Seminar/Presentation		25
Duration	16 weeks	Exam	14EPE32	Report on Internship	75
		Marks	14EPE33	Internship Evaluation and Viva-voce	50

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - IV			
HVDC POWER TRANSMISSION			
Subject Code	14EPE41	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

DC Power Transmission Technology: Introduction, comparison with AC transmission, application of DC transmission, description of DC transmission system, Planning of HVDC transmission, modern trends in DC transmission, operating problems.

HVDC Converters: Introduction to Line commutated converter, choice of converter configuration for any pulse number, analysis of 6 and 12 pulse Graetz bridge converter without overlap, effect of smoothing reactor. Two and Three level voltage source converters, Pulse Width Modulation. Analysis of converter in two and three, and three and four valve conduction modes, LCC bridge characteristics, Twelve pulse converter, detailed analysis of converters. Analysis of Capacitor Commutated and voltage source converters.

Control of Converters and HVDC link: DC link control principles, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of Dc link, Power control, Frequency control, Reactive power control, Tap changer control, Emergency control and Telecommunication requirements. Control of voltage source converter.

Converter Faults and Protection: Converter faults, protection against over currents, over voltages in converter station, surge arrestor, protection against over voltages. Protection against faults in voltage source converter.

Smoothing Reactor and DC line: Smoothing reactors, Effects of corona loss, DC line insulators, Transient over voltages in DC line, Protection in dc line, Detection and protection of faults, DC breaker

Reactive Power Control: Reactive power control in steady state and transient state, sources of reactive power, SVC and STATCOM.

Harmonics and Filters: Introduction, Generation of harmonics, design of AC and DC filters.

Power Flow Analysis in AC/DC Systems: Introduction, dc system model, solution procedure, inclusion of constraints, case study, on line power flow analysis for security control, power flow analysis under dynamic conditions, power flow with VSC based HVDC system.

Stability Analysis and Power Modulation: Introduction to stability concepts, power modulation, practical considerations in the application of modulation controllers, voltage stability, analysis of voltage stability in asynchronous AC/DC system.

Multi Terminal DC Systems: Introduction, applications, types, control and protection.

REFERENCE BOOKS

1. K. R. Padiyar, "HVDC Power Transmission Systems", New Age International, 2012.
2. E.W.Kimbark "Direct Current Transmission", Vol.1, Wiley Inter-Science, London, 2006.
3. Arrilaga, "High Voltage Direct Current Transmission", The Institute of Engineering and Technology, 2nd Edition, 2007.
4. S Kamakshaiah and V Kamaraju, "HVDC Transmission", TMH, 2011.
5. Vijay K Sood, "HVDC and FACTs Controllers; Applications of Static Converters in Power Systems, BSP Books PvtLtd, First Indian reprint 2013.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - IV			
POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES MITIGATION(ELECTIVE- III)			
Subject Code	14EPE421	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction and Characterization of Electric Power Quality: Electric Power Quality, Power Electronic applications in Power Transmission Systems, Power Electronic applications in Power Distribution Systems. Power Quality terms and Definitions, Power Quality Problems.

Analysis and Conventional Mitigation Methods: Analysis of Power Outages, Analysis of Unbalance , Analysis of Distortion, Analysis of Voltage Sag, Analysis of Voltage Flicker, Reduced Duration and Customer impact of Outages, Classical Load Balancing Problem, Harmonic Reduction, Voltage Sag or Dip Reduction.

Custom Power Devices: Introduction, Utility-Customer Interface, Custom Power Devices, Custom Power Park, Status of Application of CP Devices, Closed-Loop Switching Control, Second and higher order Systems.

Solid State Limiting, Breaking and Transferring Devices: Solid State Current Limiter, Solid State Breaker, Issues in Limiting and Switching operations, Solid State Transfer Switch, Sag/Swell Detection Algorithms.

Load Compensation using DSTATCOM: Compensating Single-Phase Loads, Ideal Three-Phase Shunt Compensator Structure, Generating Reference Currents Using Instantaneous PQ Theory, Generating reference currents using instantaneous Symmetrical Components, General Algorithm for generating reference currents, Generating Reference currents when the Source is Unbalanced.

Realization and Control of DSTATCOM: DSTATCOM Structure, Control of DSTATCOM Connected to a Stiff Source, DSTATCOM Connected to weak Supply Point, DSTATCOM Current Control through Phasors, DSTATCOM in Voltage Control Mode.

Series Compensation of Power Distribution System: Rectifier Supported DVR, DC Capacitor Supported DVR, DVR Structure, Voltage Restoration, Series Active Filter.

Unified Power Quality Conditioner: UPQC Configurations, Right-Shunt UPQC Characteristics, Left-Shunt UPQC Characteristics, Structure and Control of Right-Shunt UPQC, Structure and Control of Left-Shunt UPQC.

REFERENCE BOOKS

1. Arindam Ghosh et.al, Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publishers, 2002.
2. Math H J Bollen, "Understanding Power Quality Problems; Voltage Sags and Interruptions", Wiley India, 2011.
3. Roger C Dugan, et.al, "Electrical Power Systems Quality", 3rd Edition, TMH, 2012.
4. G T Heydt, "Electric Power Quality", Stars in Circle Publications, 1991.
5. Ewald F Fuchs, et.el, "Power Quality in Power System and Electrical Machines", Academic Press, Elsevier, 2009.
6. C. Shankaran "Power Quality", CRC Press, 2013.

M.TECH. POWER ELECTRONICS (EPE)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. POWER ELECTRONICS (EPE)
(2014-16)

I Semester

Credit Based

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical / Field Work / Assignment / Tutorials		I.A.	Exam		
14MAT11	Applied Mathematics	4	2	3	50	100	150	4
14 EPE 12	Power Semiconductor Devices	4	2	3	50	100	150	4
14 EPE 13	Modeling and Simulation of Power Electronic Systems	4	2	3	50	100	150	4
14 EPE 14	Solid State Power Controllers	4	2	3	50	100	150	4
14 EPE 15X	Elective-I	4	2	3	50	100	150	4
14 EPE 16	Power Electronics Laboratory - I	--	3	3	25	50	75	2
14 EPE 17	Seminar	--	3	--	25	--	25	1
Total		20	16	18	300	550	850	23

Elective – I

Subject Code	Name of the Subject
14EPE151	Embedded System Design
14EPE152	Soft Computing
14EPE153	Advanced Control Systems

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
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(2014-16)

II Semester

Credit Based

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical / Field Work / Assignment/ Tutorials		IA	Exam		
14EPE21	AC and DC Drives	4	2	3	50	100	150	4
14 EPE 22	Switched Mode Power Conversion	4	2	3	50	100	150	4
14 EPE 23	Power Electronics System Design using ICs	4	2	3	50	100	150	4
14 EPE24	FACTS Controllers	4	2	3	50	100	150	4
14 EPE 25X	Elective-II	4	2	3	50	100	150	4
14 EPE 26	Power Electronics Laboratory - II		3	3	25	50	75	2
14 EPE 27	Seminar	--	3	--	25	--	25	1
	**Project Phase-I (6 week Duration)	--	--	--	--	--	--	--
Total		20	16	18	300	550	850	23

**** Between the II Semester and III Semester, after availing a vacation of 2 weeks.**

Elective – II

Subject Code	Name of the Subject
14EPE251	Real Time Digital Signal Processing
14EPE252	Modeling and Analysis of Electrical Machines
14EPE253	Electro Magnetic Compatibility

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(2014-16)

III Semester: INTERNSHIP					Credit Based			
Course Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Practical/Field Work		IA	Exam		
14EPE31	Seminar/Presentation on Internship (After 8 weeks from the date of commencement)	--	--	--	25	--	25	1
14EPE32	Report on Internship	--	--	--	--	75	75	15
14EPE33	Evaluation and Viva-Voce	--	--	--	--	50	50	4
Total		--	--	--	25	125	150	20

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH. POWER ELECTRONICS (EPE)
(2014-16)

IV Semester

Credit Based

Subject Code	Subject	No. of Hrs./Week		Duration of Exam in Hours	Marks for		Total Marks	Credits
		Lecture	Field Work / Assignment / Tutorials		IA	Exam		
14EPE41	HVDC power Transmission	4	--	3	50	100	150	4
14EPE 42X	Elective-III	4	--	3	50	100	150	4
14EPE43	Evaluation of Project Phase – II	--	--	--	25	--	25	1
14EPE44	Evaluation of Project work – III	--	--	--	25	--	25	1
14EPE45	Evaluation of Project Work and Viva-voce	--	--	3	--	100+100	200	18
	Total	8	--	09	50	400	550	28

Grand Total (I to IV Sem.) : 2400 Marks; 94 Credits

Elective - III

Subject code	Name of the Subject
14EPE421	Power Quality Enhancement using Custom Power Devices
14EPE422	PWM Converters and Applications
14EPE423	DSP Applications to Drives

Note:

- 1) Project Phase – I:6 weeks duration shall be carried out between II and III Semesters. Candidates in consultation with the guides shall carryout literature survey / visit to Industries to finalise the topic of dissertation.
- 2) Project Phase – II:16 weeks duration. 3 days for project work in a week during III Semester. Evaluation shall be taken during the first two weeks of the IV Semester. Total Marks shall be 25.
- 3) Project Phase – III :24 weeks duration in IV Semester. Evaluation shall be taken up during the middle of IV Semester. At the end of the semester Project Work evaluation and Viva-Voce Examinations shall be conducted.

Total Marks shall be 250 (Phase - II Evaluation: 25 Marks, Phase – III Evaluation:25 Marks, Project Evaluation marks by Internal Examiner (Guide):50, Project Evaluation marks by External Examiner :50, Viva-Voce Examination:100 Marks).

Marks of Evaluation of Project:

- The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- 4) During the final viva, students have to submit all the reports.
 - 5) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university (Out of two external examiners at least one should be present).

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
APPLIED MATHEMATICS			
Subject Code	14MAT11	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Numerical Methods: Solution of algebraic and transcendental equations- iterative methods based on second degree equation – Muller method,(no derivation) Chebyshev method, general iteration method (first order),acceleration of convergence, system of non-linear equations, and complex roots – Newton-Raphson method, polynomial equations – Birge –Vieta method and Bairstow’s method.

Numerical Solution of Partial Differential Equations: Classification of second order equations, parabolic equations- solution of one dimensional heat equation, explicit method,Crank-Nicolson method and Du Fort-Frankel method, hyperbolic equations- solution of one dimensional wave equation.

System of Linear Algebraic Equations and Eigen Value Problems: Iterative methods - Gauss-Seidal method, SOR method, Eigen value problems – Gerschgorian circle, Eigen values and Eigen vectors of real symmetric matrices - Jacobi method, Givens method.

Interpolation:Hermite interpolation, spline interpolation, numerical solution of differential equations – Numerov method.

Optimization: Linear programming- formulation of the problem, graphical method, general linear programming problem, simplex method, artificial variable technique -M-method.

Graph Theory: Basic terminologies, types of graphs, sub graphs, graphs isomorphism, connected graphs-walks, paths, circuits, connected and disconnected graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, applications of graphs.

Linear Algebra: Vector spaces, linear dependent, independence, basis and dimension, elementary properties, examples.

Linear Transformations: Definition, properties, range and null space, rank and nullity, algebra of linear transformations- invertible, singular and non-singular transformations, representation of transformations by matrices.

REFERENCE BOOKS

1. M K Jain, S R K Iyengar and R K Jain, “Numerical Methods for Scientific and Engineering Computations”, New Age International, 2004.
2. M K Jain, “Numerical Solution of Differential Equations”, 2ndEdition, New Age International, 2008.
3. Dr. B.S. Grewal, “Numerical Methods in Engineering and Science”, Khanna Publishers, 1999.
4. Dr. B.S. Grewal, “Higher Engineering Mathematics”, 41stEdition, Khanna Publishers, 2011.
5. NarsinghDeo, “Graph Theory with Applications to Engineering and Computer Science”, PHI, 2012.
6. Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2ndEdition, PHI, 2011.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
POWER SEMICONDUCTOR DEVICES			
Subject Code	14EPE12	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Power Diodes: Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristics-turn-on transient, turn-off transient and reverse recovery transient, Schottky diodes, snubber requirements for diodes, diode snubber, modeling and simulation of power diodes.

Thyristors:- Basic structure, V-I characteristics, turn-on process, on-state operation, turn -off process, switching characteristics, turn-on transient and di/dt limitations, turn-off transient, turn-off time and reapplied dv/dt limitations, gate drive requirements, ratings of thyristors, snubber requirements and snubber design, modeling and simulation of thyristors.

Triacs: Basic structure and operation-I characteristics, ratings, snubber requirements, modeling and simulation of triacs.

Gate Turnoff Thyristor (GTO): Basic structure and operation, GTO switching characteristics, GTO turn-on transient, GTO turn -off transient, minimum on and off state times, gate drive requirements, maximum controllable anode current, overcurrent protection of GTO'S, modelling and simulation of GTO'S.

Power BJT'S: Basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and it's control- FBSOA and RBSOA curves - on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turn-on transient, turn-off transient, storage time, base drive requirements, switching losses, device protection- snubber requirements for BJT'S and snubber design - switching aids, modeling and simulation of power BJT'S.

Power MOSFET'S:- Basic structure, V-I characteristics, turn-on process, on state operation, turn-off process, switching characteristics, resistive switching specifications, clamped inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses - dv/dt limitations, gating requirements, gate charge - ratings of MOSFET'S, FBSOA and RBSOA curves, device protection -snubber requirements, modeling and simulation of Power MOSFET'S.

Insulated Gate Bipolar Transistors (IGBT'S): Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specifications - IGBT turn-on transient, IGBT turn off transient- current tailing - gating requirements -ratings of IGBT'S, FBSOA and RBSOA curves, switching losses - minimum on and off state times - switching frequency capability - overcurrent protection of IGBT'S, short circuit protection, snubber requirements and snubber design.

New Power Semiconductor Devices : MOS gated thyristors, MOS controlled thyristors or MOS GTO'S, base resistance controlled thyristors, emitter switched thyristor, thermal design of power electronic equipment, modeling and simulation, heat transfer by conduction, transient thermal impedance - heat sinks, heat transfer by radiation and convection - heat sink selection for power semiconductor devices.

REFERENCE BOOKS

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rdEdition. Wiley India Pvt Ltd, 2011.
2. G. Massobrio, P. Antognetti, "Semiconductor Device Modeling with Spice", McGraw-Hill, 2nd Edition, 2010.
3. B. JayantBaliga, "Power Semiconductor Devices", 1stEdition, International Thompson Computer Press, 1995.
4. V. Benda, J. Gowar, and D. A. Grant, "Discrete and Integrated Power Semiconductor Devices: Theory and Applications", John Wiley & Sons, 1999.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
MODELING AND SIMULATION OF POWER ELECTRONIC SYSTEMS			
Subject Code	14EPE13	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Computer Simulation of Power Electronic Converters and Systems: Challenges in computer simulation, simulation process, Types of analysis, mechanics of simulation, circuit-oriented simulators, equation solvers, comparison of circuit oriented simulators and equation solvers.

Modeling of Systems: Input-Output relations, differential equations and linearization, state space representation, transfer function representation, modeling of an armature controlled DC Motor, poles and zeros circuit averaging method of modelling approach for switched power electronic circuits, space vector modeling, space vectors, representation of space vectors in orthogonal co-ordinates, space vector transformations, modeling of induction motor, state space representation of the d-q model of the induction motor.

Digital Controller Design: Controller design techniques, Bode diagram method, PID controller, design, root locus method, state space method. Tracker, controller design, controlling voltage, controlling current.

Discrete Computation Essentials: Numeric formats, fixed -point numeric format, floating -point numeric format, tracking the base point in the fixed point system, addition of numbers, subtraction of numbers, multiplication of numbers, normalization and scaling, multiplication algorithm, arithmetic algorithm reciprocal, square root, reciprocal of square root, sine and cosine exponential, logarithm, implementation examples, pi controller, sine and cosine, pulse width modulation, space vector pwm, over-modulation.

REFERENCE BOOKS

- 1 .Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3 rd Edition, John Wiley & Sons, 2009.
2. L.Umanand, "Power Electronics Essentials and Applications", 1st Edition, John Wiley & Sons, 2009.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
SOLID STATE POWER CONTROLLERS			
Subject Code	14EPE14	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Line Commutated Converters: Phase control, single phase semi-converter & fully controlled converter, three phase semi controlled & fully controlled converter, dual converters, power factor improvement methods, effect of source inductance, single phase series converters, twelve pulse converter and design of converter circuits.

Inverters: Principle of operation, performance parameters, single phase bridge inverters and three phase inverters.

Voltage Control of Single Phase Inverters: Single/multiple, pulse/SPWM/ modified SPWM methods, voltage control of three phase inverter, SPWM/third harmonic PWM/Space vector modulation, harmonic reduction, current source inverter, comparison between VSI & CSI.

Multilevel Inverters: Introduction, types, diode clamped multi-level inverters, features & applications.

DC-DC Converters: Principle of operation, analysis of step-down and step-up converters, classification of chopper & chopper circuit design.

REFERENCE BOOKS

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rdEdition, Wiley India Pvt Ltd, 2011
2. Rashid M.H, "Power Electronics: Circuits Devices and Applications", 3rdEdition, Pearson, 2011.
3. B. K. Bose, "Modern Power Electronics & AC Drives", PHI, 2012.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
EMBEDDED SYSTEM DESIGN(ELECTIVE-I)			
Subject Code	14EPE151	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Introduction to Embedded System: An embedded system, processor, hardware unit, software embedded into a system, example of an embedded system, OS services, I/O, N/W, O/S, real time and embedded OS.

Processor and Memory Organization: Structural unit in a processor, processor selection for an embedded systems, memory devices, memory selection for an embedded system, allocation of memory to program statements and blocks and memory map of a system, direct memory accesses.

Real Time System: Types, real time computing, design issues, sample systems, hardware requirements- processor introduction, ARM various system architecture, high performance processors - strong ARM processors, addressing modes, instruction set, basic alp programs, interrupt structure.

Real Time Operating System: Fundamental requirements of RTOS, real time kernel types, schedulers, various scheduling modules with examples, latency (interrupt latency, scheduling latency and context switching latency), tasks, state transition diagram, task control block. Inter-task communication and synchronization of tasks, building real time applications.

REFERENCE BOOKS

1. Rajkamal "Embedded System Architecture: Programming & Design", TMH, 2010.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
3. Philip. A. Laplante, "Real-Time Systems Design and Analysis- An Engineer's Handbook"- 2ndEdition, Pearson.
4. Jane W.S. Liu, "Real-Time Systems", Pearson Education Inc,2012.
5. K.V.K K Prasad, "Embedded Real Time Systems: Concepts Design and Programming", Dreamtech Press New Delhi, 2003

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
POWER ELECTRONICS LABORATORY - I			
Subject Code	14EPE16	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	03
Number of Practical Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	--	Exam Marks	50

1. Analysis of static and dynamic characteristic of MOSFET and IGBT
2. Performance of single phase fully controlled and semi-controlled converter for RL load for continuous current mode
3. Performance of single phase fully controlled and semi-controlled converter for RL load for discontinuous current mode
4. Study of effect of source inductance on the performance of single phase fully controlled converter
5. Performance analysis of three phase fully controlled and semi-controlled converter for RL load for continuous current mode
6. Performance analysis of three phase fully controlled and semi-controlled converter for RL load for discontinuous current mode
7. Performance analysis of single phase bridge inverter for RL load and voltage control by single pulse width modulation
8. Performance analysis of two quadrant chopper
9. Diode clamped multilevel inverter
10. ZVS operation of a Synchronous buck converter

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - I			
SEMINAR			
Subject Code	14EPE17	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contactHours	--	Exam Marks	--

The aim of the seminar is to inculcate self-learning, face audience, enhance communication skill, involve in group discussion and present his ideas.

Each student, under the guidance of a Faculty, is required to

- i) Choose a topic of his/her interest relevant to the Course of Specialization
- ii) Carryout literature survey, organize the subject topics in a systematic order
- iii) Prepare the report with own sentences
- iv) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities
- v) Present the seminar topic at least for 20 minutes orally and/or through power point slides
- vi) Answer the queries and involve in debate/discussion lasting for about 10 minutes
- vii) Submit two copies of the typed report with a list of references

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

The internal assessment marks shall be awarded by a committee consisting of at least two staff members based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
ACANDDC DRIVES			
Subject Code	14EPE21	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Electric Drives: Introduction – block diagram-classification of electrical drives-choice of electrical drives-fundamental torque equation- components of load torque- steady state stability.

DC Drives: Single Quadrant Drive: 1-Phase semi and half wave converter drives, Two quadrant Drive: 1-phase and 3-phase full converter drive.

Two and Four Quadrant drive: 1-phase and three- phase dual converter drive, different braking methods and closed loop control of DC drives.

AC Drives: Voltage and current source inverter - inverter control-six step and PWM operation, Control of Induction motor drive -V/f and field oriented control – direct and indirect vector control, voltage and current source inverter fed induction motor drives, stator and rotor voltage control methods, slip energy recovery drives.

Closed Loop Control of AC Drives: Stator voltage control, V/f control, slip regulation, speed control of static Kramer's drive, current control, brushless DC motor, stepper motor and variable reluctance motor drives static excitation schemes of AC generator.

REFERENCE BOOKS

1. Bose B. K, "Modern Power Electronics & AC Drives" PHI, 2011.
2. Murphy JMD, Turnbull F.G., "Thyristor Control of AC Motors" Pergamon Press Oxford, 1998.
3. R.Krishanan "Electric Motor Drives", EEE, PHI, 2010.
4. MehrdadEhsani, YiminGao, AlinEmadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle Fundamentals, Theory and Design" Special Indian Edition, CRC Press 2011.
5. High Performance Control of AC Drives "Haitham Abu-Rub, Atif Iqbal, Jaroslaw Guzinski, Wiley, 2012.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
SWITCHED MODE POWER CONVERSION			
Subject Code	14EPE22	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

DC – DC Converters (Basic Converters): Linear voltage regulators (LVRs), a basic switching converter(SMPC), comparison between LVR & SMPC, principle of operation and analysis of buck converter analysis, inductor current ripple and output voltage ripple, capacitor resistance effect, synchronous rectification, design considerations, buck converter for discontinuous current operation, principle of operation and analysis of boost converter, inductor current ripple and output voltage ripple, inductor resistance effect, design considerations, boost converter for discontinuous current operation, principle of operation and analysis of buck-boost converter analysis, inductors current ripple and output voltage ripple, design considerations, buck-boost converter for discontinuous current operation, principle of operation and analysis of CUK converter , inductor current ripple and output voltage ripple, capacitor resistance effect, design considerations, single ended primary inductance converter(SEPIC).

Derived Converters: Introduction, transformer models, principle of operation and analysis of fly back converter-continuous and discontinuous current mode of operation, design considerations, principle of operation and analysis of forward converter, design considerations, double ended(Two switch) forward converter, principle of operation and analysis of push-pull converter, design considerations, principle of operation and analysis of full bridge and half-bridge DC-DC converters, design considerations, current fed converters, multiple outputs.

Control of DC-DC Converter: Modeling of DC-DC converters, power supply control, control loop stability, small signal analysis, switch transfer function, filter transfer function, PWM transfer function, Type-2 error amplifier with compensation, design, PSpice simulation of feedback control, Type-3 error amplifier with compensation, design.

Resonant Converters: Introduction, resonant switch ZCS converter, principle of operation and analysis, resonant switch ZVS converter, principle of operation and analysis, series resonant inverter, series resonant DC-DC converter, parallel resonant DC-DC converter, series- parallel resonant DC-DC converter, resonant converters comparison, resonant DC link converter.

Design of inductor and transformers for SMPC.

REFERENCE BOOKS

1. Daniel W Hart, "Power Electronics", Tata McGraw Hill, 2011.
2. Rashid M.H., "Power Electronics – Circuits Devices and Applications", 3rd Edition, Pearson, 2011.
3. D M Mitchel, "DC-DC Switching Regulator Analysis" McGraw-Hill Ltd, 1988.
4. Umanand L and Bhatt S R, "Design of Magnetic Components for Switched Mode Power Converters", New Age International, New Delhi, 2001
5. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications, and Design", 3rd Edition, Wiley India Pvt Ltd, 2010.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
POWER ELECTRONICS SYSTEM DESIGN USING ICS			
Subject Code	14EPE23	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction: Measurement techniques for voltages, current, power, power factor in power electronic circuits, other recording and analysis of waveforms, sensing of speed.

Switching Regulator Control Circuits : Introduction, isolation techniques of switching regulator systems, PWM systems.

Commercial PWM Control ICs and their Applications: TL 494 PWM Control IC, UC 1840 Programmable off line PWM controller, UC 1524 PWM control IC, UC 1846 current mode control IC, UC 1852 resonant mode power supply controller.

Switching Power Supply Ancillary, Supervisory & Peripheral Circuits and Components: Introduction, Opto-couplers, self-biased techniques used in primary side of reference power supplies, Soft/Start in switching power supplies, current limit circuits, over voltage protection, AC line loss detection.

Phase – Locked Loops (PLL) & Applications: PLL Design using ICs, 555 timer & its applications, analog to digital converter using IC's, digital to analog converters using ICs, implementation of different gating circuits.

Programmable Logic Controllers (PLC): Basic configuration of a PLC, Programming and PLC, program modification, power converter control using PLCs.

REFERENCE BOOKS

1. G. K. Dubey, S. R. Doradla, A. Johsi, and R. M. K. Sinha, "Thyristorised Power Controllers", 2nd Edition, New Age International, 2010.
2. Chryssis "High Frequency Switching Power Supplies", 2nd Edition, MGH, 1989.
3. Unitrode application notes: <http://www.smps.us/Unitrode.html>

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
FACTS CONTROLLERS			
Subject Code	14EPE24	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	02	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction: Basics of power transmission networks - control of power flow in AC - transmission line- flexible AC transmission system controllers – application of FACTS controllers in distribution systems.

AC Transmission Line and Reactive Power Compensation: Analysis of uncompensated AC Line - passive reactive power compensation - compensation by a series capacitor connected at the midpoint of the line - shunt compensation connected at the midpoint of the line - comparison between series and shunt capacitor - compensation by STATCOM and SSSC - some representative examples.

Static Var Compensator: Analysis of SVC - Configuration of SVC- SVC Controller – voltage regulator design - some issues - harmonics and filtering - protection aspects – modeling of SVC – applications of SVC.

Thyristor and GTO Controlled Series Capacitor: Introduction - basic concepts of controlled series compensation - operation of TCSC - analysis of TCSC- control of TCSC - modeling of TCSC for stability studies - GTO thyristor controlled series capacitor (GCSC) - mitigation of sub synchronous resonance with TCSC and GCSC - applications of TCSC.

Static Phase Shifting Transformer: General - basic principle of a PST - configurations of SPST improvement of transient stability using SPST - damping of low frequency power oscillations - applications of SPST.

Static Synchronous Compensator (STATCOM): Introduction - principle of operation of STATCOM - a simplified analysis of a three phase six pulse STATCOM - analysis of a six pulse VSC using switching functions - multi-pulse converters control of type 2 converters - control of type I Converters - multilevel voltage source converters - harmonic transfer and resonance in VSC, applications of STATCOM.

SSSC and UPFC:

SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow and transient stability. Unified Power Flow Controller (UPFC) – Principle of operation – modes of operation – applications – modeling of UPFC for power flow studies.

Special Purpose FACTS Controllers: Interline Power Flow Controller - operation and control.

REFERENCE BOOKS

1. K.R Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International, 2007.
2. Narain G Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, Wiley India, 2011.
3. Y. H. Song and A. T. Johns, “Flexible AC Transmission System”, Institution of Engineering and Technology, 2009.
4. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
MODELING AND ANALYSIS OF ELECTRICAL MACHINES(ELECTIVE-II)			
Subject Code	14EPE252	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	02
Total No. of Lecture Hours	52	Exam Marks	100

Basic Concepts of Modeling: Basic two pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bar and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations.

DC Machine Modeling: Mathematical model of separately excited DC motor-steady state and transient state analysis, sudden application of inertia load, transfer function of separately excited DC motor, mathematical model of dc series motor, shunt motor, linearization techniques for small perturbations.

Reference Frame Theory: Real time model of a two phase induction machine, transformation to obtain constant matrices, three phase to two phase transformation, power equivalence.

Dynamic Modeling of Three Phase Induction Machine: Generalized model in arbitrary frame, electromagnetic torque, deviation of commonly used induction motor models-stator reference frames model, rotor reference frames model, synchronously rotating reference frames model, equations in flux linkages, per unit model, dynamic simulation.

Small Signal Equations of the Induction Machine: Derivation of small signal equations of induction machine, space phasor model, DQ flux linkages model derivation, control principle of the induction motor.

Transformer Modeling: Introduction, single phase transformer model, three phase transformer connections, per phase analysis, normal systems, per unit normalization, per unit three phase quantities, change of base, per unit analysis of normal system, regulating transformers for voltage and phase angle control, auto transformers, transmission line and transformers.

Modeling of Synchronous Machines: Introduction, voltage equations and torque equation in machine variables, stator voltage equations in arbitrary and rotor reference frame variables, Park's equations, torque equations in substitute variables, rotor angle and angle between rotors, per unit system, analysis of steady state operation.

Dynamic Analysis of Synchronous Machines: Dynamic performance during sudden change in input torque and during a 3-phase fault at the machine terminals, approximate transient torque versus rotor angle characteristics, comparison of actual and approximate transient torque-angle characteristics during a sudden change in input torque; first swing transient stability limit, comparison of actual and approximate transient torque-angle characteristics during a 3-phase fault at the machine terminals, critical clearing time, equal area criterion, computer simulation.

REFERENCE BOOKS

1. P.S.Bimbra, "Generalized Theory of Electrical Machines", 5thEdition, Khanna Publications, 1995.
2. R. Krishnan, "Electric Motor Drives - Modeling, Analysis & Control", PHI Learning Private Ltd, 2009.
3. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drive Systems", 2ndEdition, Wiley(India),2010.
4. Arthur R Bergen and Vijay Vittal, "Power System Analysis", 2nd Edition, Pearson, 2009.
5. PrabhaKundur, "Power System Stability and Control", TMH, 2010.
6. Chee-MunOng, "Dynamic Simulation of Electric Machinery using Matlab / Simulink",Prentice Hall, 1998.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - II			
POWER ELECTRONICSLABORATORY - II			
Subject Code	14EPE26	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	03
Number of Practical Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Practical Hours	--	Exam Marks	50

1. Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for continuous current mode.
2. Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.
3. Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for continuous current mode.
4. Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.
5. Performance analysis of a practical chopper fed DC Drives system for class-A and class-C commutation and analysis of wave forms in continuous mode.
6. Simulation study of buck, boost and buck- boost converter (basic topologies) and analysis of wave forms for continuous current mode (CCM).
7. Simulation study of buck, boost and buck-boost converter (basic topologies) and analysis of wave forms for discontinuous current mode (DCM).
8. Simulation study of forward converter and fly back converter and performance analysis of various wave forms.
9. Resonant converter simulation study and analysis
10. Closed loop operation of a buck and boost converter.

**M.TECH. POWER ELECTRONICS (EPE)
SEMESTER - II**

SEMINAR

Subject Code	14EPE27	IA Marks	25
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of Hours	--	Exam Marks	--

M.TECH. POWER ELECTRONICS (EPE)					
SEMESTER - III					
INTERNSHIP					
Subject Code	14EPE31	IA Marks	Seminar/Presentation		25
Duration	16 weeks	Exam	14EPE32	Report on Internship	75
		Marks	14EPE33	Internship Evaluation and Viva-voce	50

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - IV			
HVDC POWER TRANSMISSION			
Subject Code	14EPE41	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

DC Power Transmission Technology: Introduction, comparison with AC transmission, application of DC transmission, description of DC transmission system, Planning of HVDC transmission, modern trends in DC transmission, operating problems.

HVDC Converters: Introduction to Line commutated converter, choice of converter configuration for any pulse number, analysis of 6 and 12 pulse Graetz bridge converter without overlap, effect of smoothing reactor. Two and Three level voltage source converters, Pulse Width Modulation. Analysis of converter in two and three, and three and four valve conduction modes, LCC bridge characteristics, Twelve pulse converter, detailed analysis of converters. Analysis of Capacitor Commutated and voltage source converters.

Control of Converters and HVDC link: DC link control principles, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of Dc link, Power control, Frequency control, Reactive power control, Tap changer control, Emergency control and Telecommunication requirements. Control of voltage source converter.

Converter Faults and Protection: Converter faults, protection against over currents, over voltages in converter station, surge arrestor, protection against over voltages. Protection against faults in voltage source converter.

Smoothing Reactor and DC line: Smoothing reactors, Effects of corona loss, DC line insulators, Transient over voltages in DC line, Protection in dc line, Detection and protection of faults, DC breaker

Reactive Power Control: Reactive power control in steady state and transient state, sources of reactive power, SVC and STATCOM.

Harmonics and Filters: Introduction, Generation of harmonics, design of AC and DC filters.

Power Flow Analysis in AC/DC Systems: Introduction, dc system model, solution procedure, inclusion of constraints, case study, on line power flow analysis for security control, power flow analysis under dynamic conditions, power flow with VSC based HVDC system.

Stability Analysis and Power Modulation: Introduction to stability concepts, power modulation, practical considerations in the application of modulation controllers, voltage stability, analysis of voltage stability in asynchronous AC/DC system.

Multi Terminal DC Systems: Introduction, applications, types, control and protection.

REFERENCE BOOKS

1. K. R. Padiyar, "HVDC Power Transmission Systems", New Age International, 2012.
2. E.W.Kimbark "Direct Current Transmission", Vol.1, Wiley Inter-Science, London, 2006.
3. Arrilaga, "High Voltage Direct Current Transmission", The Institute of Engineering and Technology, 2nd Edition, 2007.
4. S Kamakshaiah and V Kamaraju, "HVDC Transmission", TMH, 2011.
5. Vijay K Sood, "HVDC and FACTs Controllers; Applications of Static Converters in Power Systems, BSP Books PvtLtd, First Indian reprint 2013.

M.TECH. POWER ELECTRONICS (EPE)			
SEMESTER - IV			
POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES MITIGATION(ELECTIVE- III)			
Subject Code	14EPE421	IA Marks	50
No. of Lecture Hours/Week	04	Exam Hours	03
Number of Practical Hours/week	--	Number of Tutorial Hours/week	--
Total No. of Lecture Hours	52	Exam Marks	100

Introduction and Characterization of Electric Power Quality: Electric Power Quality, Power Electronic applications in Power Transmission Systems, Power Electronic applications in Power Distribution Systems. Power Quality terms and Definitions, Power Quality Problems.

Analysis and Conventional Mitigation Methods: Analysis of Power Outages, Analysis of Unbalance , Analysis of Distortion, Analysis of Voltage Sag, Analysis of Voltage Flicker, Reduced Duration and Customer impact of Outages, Classical Load Balancing Problem, Harmonic Reduction, Voltage Sag or Dip Reduction.

Custom Power Devices: Introduction, Utility-Customer Interface, Custom Power Devices, Custom Power Park, Status of Application of CP Devices, Closed-Loop Switching Control, Second and higher order Systems.

Solid State Limiting, Breaking and Transferring Devices: Solid State Current Limiter, Solid State Breaker, Issues in Limiting and Switching operations, Solid State Transfer Switch, Sag/Swell Detection Algorithms.

Load Compensation using DSTATCOM: Compensating Single-Phase Loads, Ideal Three-Phase Shunt Compensator Structure, Generating Reference Currents Using Instantaneous PQ Theory, Generating reference currents using instantaneous Symmetrical Components, General Algorithm for generating reference currents, Generating Reference currents when the Source is Unbalanced.

Realization and Control of DSTATCOM: DSTATCOM Structure, Control of DSTATCOM Connected to a Stiff Source, DSTATCOM Connected to weak Supply Point, DSTATCOM Current Control through Phasors, DSTATCOM in Voltage Control Mode.

Series Compensation of Power Distribution System: Rectifier Supported DVR, DC Capacitor Supported DVR, DVR Structure, Voltage Restoration, Series Active Filter.

Unified Power Quality Conditioner: UPQC Configurations, Right-Shunt UPQC Characteristics, Left-Shunt UPQC Characteristics, Structure and Control of Right-Shunt UPQC, Structure and Control of Left-Shunt UPQC.

REFERENCE BOOKS

1. Arindam Ghosh et.al, Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publishers, 2002.
2. Math H J Bollen, "Understanding Power Quality Problems; Voltage Sags and Interruptions", Wiley India, 2011.
3. Roger C Dugan, et.al, "Electrical Power Systems Quality", 3rd Edition, TMH, 2012.
4. G T Heydt, "Electric Power Quality", Stars in Circle Publications, 1991.
5. Ewald F Fuchs, et.el, "Power Quality in Power System and Electrical Machines", Academic Press, Elsevier, 2009.
6. C. Shankaran "Power Quality", CRC Press, 2013.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus M.Tech POWER ELECTRONICS (EPE)

Eligibility: Bachelor's degree in Engineering or Technology in

- (a) Electrical and Electronics Engineering (b) Electronics and Communication Engineering
- (c) Electronics and Telecommunication Engineering (d) Telecommunication Engineering
- (e) Electronics and Instrumentation Engineering (f) Instrumentation Engineering
- (g) Biomedical Engineering (h) Medical Electronics (i) AMIE in appropriate branch
- (i) GATE: EC, IT, EE

(Effective from Academic year 2016-17)

**BOARD OF STUDIES IN ELECTRICAL AND ELECTRONICS ENGINEERING
December 2016**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
(Total number of credits prescribed for the programme - 85)

I SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EEE11	Applied Mathematics	04	--	03	20	80	100	4
2	16EPE12	Power Semiconductor Devices and Components	04	--	03	20	80	100	4
3	16EPE13	Power Electronic Converters	04	--	03	20	80	100	4
4	16EPE14	Modelling and Design of Controllers	04	--	03	20	80	100	4
5	16EPE15X	Elective -1	03	--	03	20	80	100	3
6	16EPEL16	Power Electronics Laboratory - 1	-	3	03	20	80	100	2
7	16EPE17	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of I semester: 22

Elective - 1

Course Code under 16EPE15X	Title
16EPE151	Embedded Systems
16EPE152	Power System Harmonics
16EPE153	Advanced Control Systems
16EPE154	EMC in Power Electronics

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

II SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks		Total Marks
1	16EPE21	Electric Drives	04	--	03	20	80	100	4
2	16EPE22	Switched - Mode Power Supplies	04	--	03	20	80	100	4
3	16EPE23	Modelling and Analysis of Electrical Machines	04	--	03	20	80	100	4
4	16EPE24	FACTS Controllers	04	--	03	20	80	100	4
5	16EPE25X	Elective - 2	03	--	03	20	80	100	3
6	16EPEL26	Power Electronics Laboratory - 2	-	3	03	20	80	100	2
7	16EPE27	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of II semester: 22+ 22 = 44

Elective - 2

Course Code under 16EPE25X	Title
16EPE251	Converters for Solar and Wind Power Systems
16EPE252	Uninterruptible Power Supply
16EPE253	Power Quality Problems and Mitigation
16EPE254	Hybrid Electric Vehicles

Note: Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

III SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE31	Seminar / Presentation on Internship. (After 8 weeks from the date of commencement)			--	25	--	25	20
2	16EPE32	Report on Internship	--	--	--	25	--	25	
3	16EPE33	Evaluation and Viva-Voce of Internship	--	--	--	--	50	50	
4	16EPE34	Evaluation of Project phase -1	--	--	--	50	--	50	1
TOTAL			--	--	--	100	50	150	21

Number of credits completed at the end of III semester: 22+ 22 + 21 = 65

Note:

Internship of 16 weeks shall be carried out during III semester.

Major part of the Project work shall also be carried out during the III semester in consultation with the Guide/s.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

IV SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE41	HVDC power Transmission	04	--	03	20	80	100	4
2	16EPE42X	Elective - 3	03	--	03	20	80	100	3
3	16EPE43	Evaluation of Project phase - 2	--	--	--	50	-	50	3
4	16EPE44	Evaluation of Project and Viva-Voce	--	--	--	--	100 + 100	200	10
TOTAL			07	--	06	90	360	450	20

Number of credits completed at the end of IV semester: 22 + 22 + 21 + 20 = 85

Elective - 3

Course Code under 16EPE42X	Title
16EPE421	Digital Power Electronics
16EPE422	MPPT in Solar Systems
16EPE423	Multi-Terminal DC Grids
16EPE424	Multilevel Converters for Industrial Applications

Note: 1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted

4. Project evaluation:

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
APPLIED MATHAMATICS (Core Course)			
Course Code	16EEE11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> The objectives of this course is to acquaint the students with principles of advanced mathematics through linear algebra, transform methods for differential equations, calculus of variations and linear and non-linear programming, that serve as an essential tool for applications of electrical engineering sciences. ■ 			
Module-1			Teaching Hours
Numerical Methods: Solution of algebraic and transcendental equations- iterative methods based on second degree equation – Muller method(no derivation), Chebyshev method. Fixed point iteration method (first order), acceleration of convergence- Δ^2 - Aitken’s method. System of non-linear equations – Newton-Raphson method. Complex roots by Bairstow’s method. ■			10
Revised Bloom’s Taxonomy Level	L ₂ – Understanding, L ₃ – Applying		
Module-2			
Numerical Solution of Partial Differential Equations: Classification of second order equations, parabolic equations-solution of one dimensional heat equation, explicit method, Crank-Nicolson method. Hyperbolic equations- solution of one dimensional wave equation and two-dimensional Laplace equation by explicit method. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying		
Module-3			
Linear Algebra: Vector spaces, linear dependent, independence, basis and dimension, elementary properties, examples. Linear Transformations: Definition, properties, range and null space, rank and nullity, algebra of linear transformations-invertible, singular and non-singular transformations, representation of transformations by matrices. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding		
Module-4			
System of linear algebraic equations and Eigen value problems: Iterative methods - Gauss-Seidal method, SOR method, Eigen value problems – Gerschgorian circle theorem, Eigen values and Eigen vectors of real symmetric matrices -Jacobi method. Interpolation: Hermite interpolation, spline interpolation, numerical solution of differential equations – Numerov method. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying		
Module-5			
Optimization: Linear programming- formulation of the problem, general linear programming problem, simplex method, artificial variable technique, Big M-method. Graph Theory: Basic terminologies, types of graphs, sub graphs, graphs isomorphism, connected graphs-walks, paths, circuits, connected and disconnected graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, applications to electrical circuits. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)
16EEE11 APPLIED MATHAMATICS (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

1. Employ numerical techniques in order to achieve more accurate values in the computation of roots of algebraic and non-linear equations.
2. Utilize analytical and numerical schemes to solve partial differential equations applicable to engineering problems.
3. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
4. Apply standard iterative methods to compute Eigen values and solve ordinary differential equations.
5. Employ linear and non-linear programming techniques in simulation of network systems and optimization of electrical circuits. ■

Graduate Attributes (As per NBA):

Critical Thinking, Problem Solving, Research Skill, Usage of Modern Tools.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Text/Reference Books

1	Linear Algebra and its Applications	David C.Lay et al	Pearson	5th Edition,2015
2	Numerical methods in Engineering and Science (with C, C++ & MATLAB)	B.S.Grewal	Khanna Publishers	2014
3	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	PHI	2012
4	Numerical Methods for Scientific and Engineering Computation	M. K. Jain et al	New Age International	9 th Edition, 2014
5	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition,2015
6	Linear Algebra	K.Hoffman et al	PHI	2011
7	Web links: 1. http://nptel.ac.in/courses.php?disciplineId=111 2. http://www.class-central.com/Course/math(MOOCs) 3. www.wolfram.com			

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
POWER SEMICONDUCTOR DEVICES AND COMPONENTS (Core Course)			
Course Code	16EPE12	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To enhance the knowledge of fundamentals of semiconductor physics, power electronics and power computation in circuits • To enhance the knowledge of fundamentals of various semiconductor devices, their operation and characteristics. • To explain the design and operation of drive circuits and snubber circuits. • To explain the controlling of temperature rise of the semiconductor devices and designing of magnetic components used for the power electronic circuits. ■ 			
Module-1			Teaching Hours
<p>Power Electronics: Introduction, Converter Classification, Power Electronics Concepts, Electronic Switches, Switch Selection, Spice, PSpice and Capture, Representation of switches in Pspice -The Voltage-Controlled Switch, Transistors, Diodes and Thyristors (SCRs).</p> <p>Power Computations: Introduction, Power and Energy, Inductors and Capacitors, Energy Recovery, Effective Values, Apparent Power and Power Factor, Power Computations for Sinusoidal AC Circuits, Power Computations for Nonsinusoidal Periodic Waveforms, Power Computations Using Pspice.</p> <p>Basic Semiconductor Physics: Introduction, Conduction Processes in Semiconductors pn Junctions, Charge Control Description of pn-Junction Operation, Avalanche Breakdown. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Power Diodes: Introduction, Basic Structure and I – V characteristics, Breakdown Voltage Considerations, On –State Losses, Switching Characteristics, Schottky Diodes.</p> <p>Bipolar Junction Transistors: Introduction, Vertical Power Transistor Structures, Z-V Characteristics, Physics of BJT Operation, Switching Characteristics, Breakdown Voltages, Second Breakdown, On-State Losses, Safe Operating areas.</p> <p>Power MOSFETs : Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Operating Limitations and Safe Operating Areas. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Thyristors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Methods of Improving di/dt and dv/dt Ratings.</p> <p>Gate Turn-Off Thyristors: Introduction, Basic Structure and Z-V Characteristics, Physics of Turn-Off Operation, GTO Switching Characteristics, Overcurrent Protection of GTOs.</p> <p>Insulated Gate Bipolar Transistors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Latchup in IGBTs, Switching Characteristics, Device Limits and SOAs.</p> <p>Emerging Devices and Circuits: Introduction, Power Junction Field Effect Transistors, Field-Controlled Thyristor, JFET-Based Devices versus Other Power Devices, MOS-Controlled Thyristors, Power Integrated Circuits, New Semiconductor Materials for Power Devices. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) 16EPE12 POWER SEMICONDUCTOR DEVICES AND COMPONENTS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
<p>Snubber Circuits: Function and Types of Snubber Circuits, Diode Snubbers, Snubber Circuits for Thyristors, Need for Snubbers with Transistors, Turn-Off Snubber, Overvoltage Snubber, Turn-On Snubber, Snubbers for Bridge Circuit Configurations, GTO Snubber Considerations.</p> <p>Gate and Base Drive Circuits: Preliminary Design Considerations, dc-Coupled Drive Circuits, Electrically Isolated Drive Circuits, Cascode-Connected Drive Circuits, Thyristor Drive Circuits, Power Device Protection in Drive Circuits, Circuit Layout Considerations ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
<p>Component Temperature Control and Heat Sinks: Control of Semiconductor Device Temperatures, Heat Transfer by Conduction, Heat sinks, Heat Transfer by Radiation and Convection.</p> <p>Design of Magnetic Components: Magnetic Materials and Cores, Copper Windings, Thermal Considerations, Analysis of a Specific Inductor Design, Inductor Design Procedures, Analysis of a Specific Transformer Design, Eddy Currents, Transformer Leakage Inductance, Transformer Design Procedure, Comparison of Transformer and Inductor Sizes. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss power electronic concepts, electronic switches and semiconductor physics. • Explain representation of switches in P-spice and power computations. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; power diodes, power BJT, power MOSFET. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; thyristors, power IGBT, power FET. • Design Snubber circuits for the protection of power semiconductor devices. • Design gate and base drive circuits for power semiconductor devices • Design a heat sink to control the temperature rise of semiconductor devices • Design magnetic components inductors and transformers used in the power electronic circuits. ■ 				
Graduate Attributes (As per NBA):				
Engineering Knowledge Problem, Analysis, Design / development of solutions, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics	Daniel W Hart	McGraw Hill	
2	Power Electronics Converters, Applications, and Design	Ned Mohan et al	Wiley	3 rd Edition, 2014
3	Semiconductor Device Modeling with Spice	G. Massobrio, P. Antognetti	McGraw-Hill	2 nd Edition, 2010
4	Power Semiconductor Devices	B. Jayant Baliga	Springer	2008

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I			
POWER ELECTRONIC CONVERTERS (Core Course)			
Course Code	16EPE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of PWM techniques in controlling the converter operation. • To impart knowledge of designing and analyzing DC – DC PWM converters and control modules. • To impart knowledge of designing and analyzing DC – AC and AC – DC converters. • To impart knowledge of analyzing different types of resonant converters and their control. • To impart knowledge of AC –AC converters and multilevel controllers. ■ 			
Module-1			Teaching Hours
PWM DC/DC Converters: Forward Converters - Analysis of the Basic Circuit, Galvanically Isolated Forward Converter, Boost Converter - Analysis of the Basic Scheme, Variation of the Output Voltage, Boundary Between the Continuous and the Discontinuous Mode , Discontinuous Mode Power Losses, Indirect Converter - Boundary Between the Continuous and the Discontinuous Mode, Discontinuous Mode, Indirect Converter with Galvanic Separation, Push – Pull (Symmetric) Converters - Analysis of Idealized Circuit in Continuous Mode, Output Characteristics, Selection of Components, DC Premagnetization of the Core, Half-Bridge Converter, Bridge Converter, Hamilton Circuit, Ćuk Converters - Elimination of the Current Ripple, Ćuk Converters with Galvanic Isolation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Control Modules: Basic Principles and Characteristics of PWM Control Modules - Circuit Analysis, Simple PWM, Voltage-Controlled PWM, Current-Controlled PWM- Compensated PWM, IC Control Modules - Control Module TL494, Control Module SG1524/2524/3524, Control Module TDA 1060. DC/AC Converters – Inverters: Single-Phase Voltage Inverters - Pulse-Controlled Output Voltage, Pulse-Width Modulated Inverters - Unipolar PWM, Three-Phase Inverters-Overmodulation ($m_a > 1$), Asynchronous PWM, Space Vector Modulation - Space Vector Modulation: Basic Principles, Application of Space Vector Modulation Technique, Direct and Inverse Sequencing, Real Drive Influence. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
AC/DC Converters – Rectifiers: Half-Wave Single-Phase Rectifiers , Full-Wave Rectifiers - Commutation of Current, Output Filters - Capacitive Filter, L Filter, Voltage Doublers, Three-Phase Rectifiers, Phase Controlled Rectifiers - Full-Wave Thyristor Rectifiers, Three-Phase Thyristor Bridge Rectifiers, Twelve-Pulse Rectifiers, Rectifiers with Circuit for Power Factor Correction, Active Rectifier - Active Rectifier with Hysteresis Current Controller, PWM Rectifiers - Advanced Control Techniques of PWM Rectifiers , PWM Rectifier with Current Output, PWM Rectifiers in Active Filters, Some Topologies of PWM Rectifiers, Applications of PWM Rectifiers. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

M.TECH POWER ELECTRONICS (EPE) 16EPE13 POWER ELECTRONIC CONVERTERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
Resonant Converters: Resonant Circuits - Resonant Converters of Class D, Series Resonant Converters, Parallel Resonant Converters, Series – Parallel Resonant Converter, Series Resonant Converters Based on GTO Thyristors, Class E Resonant Converters, DC/DC Converters Based on Resonant Switches - ZCS Quasi-resonant Converters, ZVS Quasi-resonant Converters, Multiresonant Converters, ZVS Resonant DC/AC Converters, Soft Switching PWM DC/DC Converters -Phase Shift Bridge Converters, Resonant Transitions PWM Converters, Control Circuits of Resonant Converters - Integrated Circuit Family UCx861-8, Integrated Circuits for Control of Soft, Switching PWM Converters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
AC/AC Converters: Single-Phase AC/AC Voltage Converters - Time Proportional Control Three-Phase Converters, Frequency Converters, Direct Frequency Converters, Introduction to AC/AC Matrix Converters - Basic Characteristics, Bidirectional Switches, Realization of Input Filter, Current Commutation, Protection of Matrix Converter, Application of Matrix Converter. Introduction to Multilevel Converters: Basic Characteristics -Multilevel DC/DC Converters, Time Interval: $nT < t < nT + DT$, $n = 0, 1, 2$, Time Interval: $nT + DT < t < (n + 1)T$, Multilevel Inverters - Cascaded H-Bridge Inverters, Diode-Clamped Multilevel Inverters, Flying Capacitor Multilevel Inverter, Other Multilevel Inverter Topologies, Control of Multilevel Inverters - Multilevel SPWM, Space Vector Modulation, Space Vector Control, Selective Harmonic Elimination. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Use the knowledge of PWM techniques in controlling different power electronic converters. • Apply the knowledge of power electronics in design and analysis of DC –DC PWM converters. • Design and analyze DC –AC and AC – DC converters and control their operation using PWM techniques. • Design and analyze different resonant converters and their control circuits. • Analyze AC – AC converters and multilevel converters. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters and Regulators	Branko L. Doki ć Branko Blanu š a	Springer (International Publishing, Switzerland)	3 rd Edition, 2015
2	Power Electronics Converters, Applications, and Design	Ned Mohan et al	Wiley	3 rd Edition, 2014

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I			
MODELLING AND DESIGN OF CONTROLLERS (Core Course)			
Course Code	16EPE14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge required for modeling and computer simulation of power electronic converters and systems. • To explain control system essentials in representing system in digital domain. • To explain the designing of digital controllers by different methods. • To explain the design and analysis of optimal and robust controllers by different methods. • To impart knowledge of discrete computation essentials. ■ 			
Module-1			Teaching Hours
Computer Simulation of Power Electronic Converters and Systems: Introduction, Challenges in Computer Simulation, Simulation Process, Mechanics of Simulation, Solution Techniques for Time-Domain Analysis, Widely Used, Circuit-Oriented Simulators, Equation Solvers. Modelling of Systems: Input-Output relations, Differential Equations and Linearization, State Space Representation, Transfer Function Representation, Block Diagrams, Lagrange method, Circuit Averaging, Bond Graphs, Space Vector Modelling. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Control System Essentials: Representation of system in digital Domain, The Z – Transform, Digital Filter, Mapping between s – plane and z – plane, Effect of Sampling, Continuous to Discrete Domain Conversion, Control System Basics, Control Principles, State - Space Method. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Digital Controller Design: Controller Design Techniques, Bode Diagram Method, PID Controller, Root Locus Method, State Space Method, Full State Feedback, Regulator Design by Pole Placement, Estimation Design, Tracker : Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Digital Controller Design (continued): Controlling Voltage, Controlling Current, Control of Induction motor, Output Feedback, Induction motor Control with Output Feedback. Optimal and Robust Controller Design: Least Squares Principle, Quadratic Forms, Minimum Energy Principle, Least Square Solution, Weighted Least Squares, Recursive Least Squares, Optimal Control: Linear Quadratic, Induction motor example, Robust Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) 16EPE14 MODELLING AND DESIGN OF CONTROLLERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Discrete Computation Essentials: Numeric Formats, Tracking the Base Point in the Fixed Point System, Normalization And Scaling, Arithmetic Algorithms. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the role of computer simulations in the analysis and design of power electronics systems. • Understand the functional modeling of static systems. • Use sampling technique to determine a digital equivalent to a continuous time system. • Understand the control basics of digital systems. • Design digital controllers in discrete time and frequency domain. • Design optimal and robust controllers by different methods. • Explain essentials of discrete computation. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, William P. Robbins	Wiley	3 rd Edition,2014
2	Power Electronics Essentials and Applications	L.Umanand	Wiley	1 st Edition,2014

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
EMBEDDED SYSTEMS (Elective Course)			
Course Code	16EPE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of embedded systems with suitable examples, explanation of process, classification of embedded systems. • To explain the processor architecture, memory organization, communication with processor and interrupt services. • To explain the program modeling concepts, inter-process communication and synchronization of processes. ■ 			
Module-1			Teaching Hours
Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems – on –chip (Soc) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design of Process in Embedded System, Formulation of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skill required for an Embedded System Designer. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Processor Architecture and Memory Organisation: 8051 Architecture, Real world Interfacing, Introduction to Advanced Architecture, Processor and Memory Organization, Instruction Level Parallelism, Performance Metrics, Memory – Types, Memory – Maps and Addresses, Processor Selection, Memory Selection. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Devices and Communication Buses, Interrupt Services: IO Types and Examples, Serial Communication Devices, Parallel Device Ports, Sophisticated Interfacing Features in Device Ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Serial Bus Device Protocols – Parallel Communication Network Using ISA, PCI, PCI –X and Advanced Protocols.			08
Device Drivers and Interrupts Service Mechanisms: Programmed – I/O Busy – wait Approach without Interrupt Service Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing Mechanism, Direct Memory Access. ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Program Modelling concepts: Program Models, DFG Models, State Machine Programming Models for Event – controlled Program Flow, Modelling of Multiprocessor Systems, UML Modelling.			08
Interprocess Communication and Synchronization of Processes, Threads and Tasks: Multiple Processes in an Application, Multiple Threads in an Application, Tasks, Task Status, Task and Data, Clear – cut Distention Between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Interprocess Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions. ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) 16EPE151 EMBEDDED SYSTEMS (Elective Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Real - Time Operating Systems: OS Services, Process Management, Timer Functions, Event Functions, Memory management, Device, File and IO Subsystems Management , Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real – time Operating Systems, Basic Design Using an RTOS, Rtos Task Scheduling Models, Interrupt Latency and Response of the task as performance Metrics, OS Security Issues. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain design process in embedded system and formulation of system design. • Describe processor architecture and memory organization. • Describe the devices; serial port, parallel port devices, timing devices, devices for synchronous iso-synchronous and asynchronous communication. • Describe device drivers and interrupt mechanisms. • Explain the programming concepts and source code engineering tools for embedded programming. • Explain real time programming and program modeling concepts during single and multi-processor system software development process. • Describe real time operating systems concepts. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Embedded Systems: Architecture, Programming and Design	Raj Kamal	Mc Graw Hill	2 nd Edition,2014

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I POWER ELECTRONICS LABORATORY-1			
Course Code	16PEEL16	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	40	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiment on various power electronic devices to analyze their static and dynamic characteristics. • To conduct experiments and enhance understanding of different power electronic converters. ■ 			
Sl. NO	Experiments		
1	Analysis of static and dynamic characteristic of MOSFET and IGBT.		
2	Performance of single phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
3	Performance of single phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
4	Study of effect of source inductance on the performance of single phase fully controlled converter.		
5	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
6	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
7	Performance analysis of single phase bridge inverter for RL load and voltage control by single pulse width modulation.		
8	Performance analysis of two quadrant chopper.		
9	Diode clamped multilevel inverter.		
10	ZVS operation of a Synchronous buck converter.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Analyze the static and dynamic characteristics of various semiconductor devices. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for continuous current modes. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for discontinuous current modes. • Assess the performance of single phase bridge inverter for RL load and control the voltage by pulse width modulation. • Apply the knowledge of power electronics in performance analysis of chopper and synchronous buck converter. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I SEMINAR			
Course Code	16EPE17	IA Marks	100
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contact Hours	--	Exam Marks	--
Credits - 01			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The Internal Assessment marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman. ■</p>			
<p>Marks distribution for internal assessment of the course 16EPE17 seminar: Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks</p>			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
(Total number of credits prescribed for the programme - 85)

II SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks		Total Marks
1	16EPE21	Electric Drives	04	--	03	20	80	100	4
2	16EPE22	Switched - Mode Power Supplies	04	--	03	20	80	100	4
3	16EPE23	Modelling and Analysis of Electrical Machines	04	--	03	20	80	100	4
4	16EPE24	FACTS Controllers	04	--	03	20	80	100	4
5	16EPE25X	Elective - 2	03	--	03	20	80	100	3
6	16EPEL26	Power Electronics Laboratory - 2	-	3	03	20	80	100	2
7	16EPE27	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of II semester: 22+ 22 = 44

Elective - 2

Course Code under 16EPE25X	Title
16EPE251	Converters for Solar and Wind Power Systems
16EPE252	Uninterruptible Power Supply
16EPE253	Power Quality Problems and Mitigation
16EPE254	Hybrid Electric Vehicles

Note: Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
ELECTRIC DRIVES (Core Course)			
Course Code	16EPE21	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to drive, their characteristics and breaking. • To explain the basic elements of drives, classification of drives, their dynamics and speed control • To explain selection of drive for a specific application. • To explain control of an electric drive using microprocessor. ■ 			
Module-1			Teaching Hours
Characteristics Electric motors: Introduction, Characteristics of DC motors, Three phase Induction Motors and Synchronous Motors, Braking of Electric Motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Dynamics of Electric Drives: Introduction, Classification of Electric Drives, Basic Elements of an Electric Drive, Dynamic Conditions of Drive System, Stability Considerations of Electric Drive. Control of Electric Motors: Induction Motor Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of Electric Motors (continued): Synchronous Motor Drives, DC Drives. Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Control of Electric Motors (continued): Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. Applications: Drive Considerations for Textile Mills, Steel Rolling Mills, Cranes and Hoist Drives, Cement Mills, Sugar Mills, Machine Tools, Paper Mills, Coal Mines, Centrifugal Pumps, Turbo - compressors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Microprocessors and Control of Electrical Drives: Introduction, Dedicated Hardware Systems versus Microprocessor Control, Applications Area and Functions of Microprocessors in Drive Technology, Control of Electric Drives using Microprocessors, Control System Design of Microprocessors based Variable Speed Drives, Stepper motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE)
16EPE21 ELECTRIC DRIVES (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain characteristics of DC motors, induction motors and synchronous motors.
- Explain braking of electric motors.
- Classify electric drives.
- Discuss dynamics conditions and stability considerations of Electric drive.
- Control the speed of electric motors.
- Suggest a drive for a specific application.
- Explain using microprocessor in the control of an electric drive. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electric Drives Concepts and Applications	Vedam Subrahmanyam	Mc Graw Hill	2 nd Edition, 2016
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M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
SWITCHED - MODE POWER SUPPLIES (Core Course)			
Course Code	16EPE22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview on SMPS, its characteristics, new technologies, basic principles and control modes. • To introduce the topology of DC/DC converter used and the method of selecting key peripheral components of SMPS. • To explain the power factor correction circuit design of SMPS, the design of high-frequency transformer, the examples of SMPS optimization design, and the key design points of SMPS. • To introduce the SMPS testing technology and the protection circuit design of SMPS. ■ 			
Module-1			Teaching Hours
<p>Switching-Mode Power Supply (SMPS): Overview, Classification of Integrated Regulated Power Supply, Characteristics of SMPS, New Development Trend of SMPS, Basic Principles of SMPS, Control Mode Type of SMPS, Working Mode of SMPS, Feedback Type of SMPS, Load Characteristics of SMPS.</p> <p>Topologies of the DC/DC Converter: Topologies of the DC/DC Converter, Basic Principle of Buck Converter, Basic Principle of - Boost Converter, Buck-Boost Converter, Charge Pump Converter, (Single-ended primary inductor converter)SEPIC, Flyback Converter, Forward Converter, Push-Pull Converter, Half/Full Bridge Converter, Soft Switching Converter, Half-Bridge LLC Resonant Converter, 2-Switch Forward Converter. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Method for Selecting Key Peripheral Components of SMPS: Selection Method for - Fixed Resistor, Capacitors, Inductor Characteristics and Selection Method for Magnetic Beads, Selection Method for EMI Filter - Input Bridge Rectifier, Output Rectifier, Transient Voltage Suppressor (TVS), Power Switching Tube, Optical Coupler, Adjustable Precision Shunt Regulator, SMPS Protection Elements. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Power Factor Correction Circuit Design of SMPS: Brief Introduction to Power Factor Correction (PFC), Basic Principle of Passive PFC Circuit, Design Examples of Passive PFC Circuit, Basic Principle of Active PFC Circuit, Design Examples of Active PFC Circuit, Principle and Application of High-Power PFC, Measures to Suppress PFC Electromagnetic Interference, PFC Configuration Scheme.</p> <p>Design of High-Frequency Transformer: Selection Method for Magnetic Cores by the Empirical Formula or Output Power Table, Waveform Parameters of the High-Frequency Transformer Circuit, Formula Derivation of Selecting High-Frequency Transformer Magnetic Core Based on AP Method, Design of Flyback High-Frequency Transformer, Design of Forward High-Frequency Transformer, Loss of High-Frequency Transformer. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ – Applying.		

M.TECH POWER ELECTRONICS (EPE) 16EPE22 SWITCHED - MODE POWER SUPPLIES (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
<p>Key Design Points of SMPS: SMPS Design Requirements, Design of High-Efficiency SMPS, Methods of Reducing No-Load and Standby Power Consumption of SMPS, Stability Design of Optocoupler Feedback Control Loop SMPS Layout and Wiring, Design of Constant Voltage/Current SMPS, Design of Precision Constant Voltage/Current SMPS, Design of Remote Turn-Off Circuit for SMPS, Typical Application and Printed Circuit Design of New Single-Chip SMPS, Electromagnetic Interference Waveform Analysis and Safety Code Design of SMPS, Radiator Design of Single-Chip SMPS, Radiator Design of Power Switching Tube (MOSFET), Common Troubleshooting Methods of SMPS. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.			
Module-5				
<p>SMPS Testing Technology: Parameter Testing of SMPS, Performance Testing of SMPS, SMPS Measurement Skills, Accurate Measurement Method of Duty Ratio, Method to Detect the Magnetic Saturation of High-Frequency Transformer with Oscilloscope, Digital Online Current/Resistance Meter, Electromagnetic Compatibility Measurement of SMPS, Waveform Test and Analysis of SMPS.</p> <p>Protection and Monitoring Circuit Design of SMPS: Design of Drain Clamp Protection Circuit, Overvoltage Protection Circuit Constituted by Discrete Components, Application of Integrated Overvoltage Protector, Design of Undervoltage Protection Circuit, Design of Overcurrent and Overpower Protection Circuit, Design of Soft-Start Circuit, Mains Voltage Monitor, Transient Interference and Audio Noise Suppression Technology of SMPS, Design of Overheating Protection Component and Cooling Control System. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain a SMPS, its characteristics, new technologies, basic principles and control modes. • Suggest a suitable DC/DC converter for an SMPS. • Explain the method of selecting key peripheral components of SMPS. • Design the power factor correction circuit of SMPS. • Explain selection of magnetic core and designing of high-frequency transformer. • Explain designing of different SMPS. • Explain testing technology of SMPS. • Design protection and monitoring circuit for SMPS. ■ 				
Graduate Attributes (As per NBA):				
Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics, Communication.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Optimal Design of Switching Power Supply	Zhanyou Sha et al	Wiley	2015

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Core Course)			
Subject Code	16EPE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To provide basic concepts of modelling of dc and ac machines. • To provide knowledge of theory of transformation of three phase variable to two phase variable. • To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modelling. • To provide modeling concepts of single phase and three phase transformers. • To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modelling. ■ 			
Module-1			Teaching Hours
<p>Basic Concepts of Modelling: Basic two pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bar and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations.</p> <p>DC Machine Modelling: Mathematical model of separately excited DC motor-steady state and transient state analysis, sudden application of inertia load, transfer function of separately excited DC motor, mathematical model of dc series motor, shunt motor, linearization techniques for small perturbations. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Reference Frame Theory: Real time model of a two phase induction machine, transformation to obtain constant matrices, three phase to two phase transformation, power equivalence.</p> <p>Dynamic Modelling of Three Phase Induction Machine: Generalized model in arbitrary frame, electromagnetic torque, deviation of commonly used induction motor models-stator reference frames model, rotor reference frames model, synchronously rotating reference frames model, equations in flux linkages, per unit model, dynamic simulation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Small Signal Equations of the Induction Machine: Derivation of small signal equations of induction machine, space phasor model, DQ flux linkages model derivation, control principle of the induction motor.</p> <p>Transformer Modelling: Introduction, single phase transformer model, three phase transformer connections, per phase analysis, normal systems, per unit normalization, per unit three phase quantities, change of base, per unit analysis of normal system, regulating transformers for voltage and phase angle control, auto transformers, transmission line and transformers. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
<p>Modelling of Synchronous Machines: Introduction, voltage equations and torque equation in machine variables, stator voltage equations in arbitrary and rotor reference frame variables, Park's equations, torque equations in substitute variables, rotor angle and angle between rotors, per unit system, analysis of steady state operation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)				
16EPE23 MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Core Course) (continued)				
CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Dynamic Analysis of Synchronous Machines: Dynamic performance during sudden change in input torque and during a 3-phase fault at the machine terminals, approximate transient torque versus rotor angle characteristics, comparison of actual and approximate transient torque-angle characteristics during a sudden change in input torque; first swing transient stability limit, comparison of actual and approximate transient torque-angle characteristics during a 3-phase fault at the machine terminals, critical clearing time, equal area criterion, computer simulation. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the basic concepts of modeling. • Develop mathematical models for DC motors for transient state analysis. • Use reference frame theory to transform three phase to two phase. • Develop dynamic model for three phase induction motor in stator and rotor reference frames. • Develop mathematical model of single phase transformers. • Model synchronous machine using Park's transformation for the analysis of steady state operation. • Model synchronous machine to perform dynamic analysis under different conditions. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Ethics,				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Generalized Theory of Electrical Machines	P.S.Bimbra	Khanna Publications	5th Edition,1995
2	Electric Motor Drives - Modelling, Analysis & Control	R. Krishnan	PHI Learning Private Ltd	Indian Edition, 2009
3	Analysis of Electrical Machinery and Drive Systems	P.C.Krause, et al	Wiley	2nd Edition,2010
4	Power System Analysis	Arthur R Bergen and Vijay Vittal	Pearson	2 nd Edition,2009
5	Power System Stability and Control	Prabha Kundur	Mc Graw Hill	1 st Edition,1994
6	Dynamic Simulation of Electric Machinery using Matlab / Simulink	Chee-Mun Ong	Prentice Hall	1998

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
FACTS CONTROLLERS (Core Course)			
Course Code	16EPE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss the growth of complex electrical power networks and to introduce the lack of controllability of the active- and reactive-power flows in energized networks. • To describe the conventional controlled systems and introduce the basic operating principles of new FACTS devices • To describe the various components of a general SVC, its control system, an overview of the voltage-control characteristics of SVC and the principles of design of the SVC voltage regulator. • To explain the concepts of SVC control in such applications as stability enhancement, damping subsynchronous oscillations, improvement of HVDC link performance and the basic issues relating to the design of SVC controllers in different applications. • To explain the concepts of series compensation, TCSC controller and its operation, characteristics, modeling and applications. • To introduce voltage source converter based facts devices. ■ 			
Module-1			Teaching Hours
Control Mechanism of Transmission System: Background, Electrical Transmission Networks, Conventional Control Mechanisms, Flexible ac Transmission Systems (FACTS), Emerging Transmission Networks. Reactive-Power Control in Electrical Power Transmission Systems: Reactive Power, Uncompensated Transmission Lines, Passive Compensation. Principles of Conventional Reactive-Power Compensators: Introduction, Synchronous Condensers, The Saturated Reactor (SR), The Thyristor-Controlled Reactor (TCR), The Thyristor-Controlled Transformer (TCT). ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Principles of Conventional Reactive-Power Compensators (continued): The Fixed Capacitor–Thyristor-Controlled Reactor (FC–TCR), The Mechanically Switched Capacitor–Thyristor-Controlled Reactor (MSC–TCR), The Thyristor-Switched Capacitor (TSC), The Thyristor-Switched Capacitor–Thyristor-Controlled Reactor (TSC–TCR), A Comparison of Different SVCs. SVC Voltage Control: Introduction Voltage Control. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
SVC Voltage Control (continued): Effect of Network Resonances on the Controller Response, The 2nd Harmonic Interaction between the SVC and ac Network, Application of the SVC to Series-Compensated ac Systems, 3rd Harmonic Distortion, Voltage-Controller Design Studies. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
SVC Applications: Introduction, Increase in Steady-State Power-Transfer Capacity, Enhancement of Transient Stability, Augmentation of Power-System Damping - Principle of the SVC, Auxiliary Control, Torque Contributions of SVC Controllers, Effect of the Power System, Effect of the SVC, SVC Mitigation of Subsynchronous Resonance (SSR) - Principle of SVC Control, Configuration and Design of the SVC Controller, Rating of an SVC, Prevention of Voltage Instability- Principles of SVC Control- A Case Study, Configuration and Design of the SVC Controller, Rating of an SVC.			10

M.TECH POWER ELECTRONICS (EPE) 16EPE24 FACTS CONTROLLERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4 (continued)				Teaching Hours
The Thyristor-Controlled Series Capacitor (TCSC): Series Compensation, The TCSC Controller, Operation of the TCSC, The TSSC, Analysis of the TCSC, Capability Characteristics, Harmonic Performance, Losses, Response of the TCSC, Modelling of the TCSC. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
TCSC Applications: Introduction, Open-Loop Control, Closed-Loop Control, Improvement of the System-Stability Limit, Enhancement of System Damping, Subsynchronous Resonance (SSR) Mitigation, Voltage-Collapse Prevention. VSC based FACTS Controllers: Introduction, The STATCOM, The SSSC, The UPFC, Comparative Evaluation of Different FACTS Controllers. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss the growth of complex electrical power networks, the lack of controllability of the active- and reactive-power flows in energized networks. • Describe the conventional controlled systems and the basic operating principles of FACTS. • Describe the various components of a general SVC, its control system, control characteristics and the design of the SVC voltage regulator. • Explain the use of SVC in stability enhancement, damping subsynchronous oscillations, improvement of HVDC link performance. • Explain the concepts of series compensation, TCSC controller and its operation, characteristics, modeling and applications. • Explain the operation of voltage source converter based FACTS. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Lifelong Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Thyristor-Based FACTS Controllers for Electrical Transmission Systems	R. Mohan Mathur Rajiv K. Varma	Wiley	2002
2	Understanding FACTS : concepts and technology of flexible AC Transmission systems	Narain G. Hingorani Laszlo Gyugyi.	Wiley	2000
3	Facts Controllers in Power Transmission and Distribution	K. R. Padiyar	New Age International	2007

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
POWER QUALITY PROBLEMS AND MITIGATION (Elective Course)			
Course Code	16EPE253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction on power quality (PQ), causes and effects of PQ problems, requirement of PQ improvements, and mitigation aspects of PQ problems. • To give PQ definitions, terminologies, standards, benchmarks, monitoring requirements through numerical problems. • To explain passive shunt and series compensation using lossless passive LC components, active shunt compensation using DSTATCOM (distribution static compensators), active series compensation using DVR (dynamic voltage restorer), and combined compensation using UPQC (unified power quality compensator) for mitigation of current-based PQ problems. • To explain classification, modeling and analysis of various nonlinear loads which cause the power quality problems. ■ 			
Module-1			Teaching Hours
<p>Power Quality: Introduction, State of the Art on Power Quality, Classification of Power Quality Problems, Causes of Power Quality Problems, Effects of Power Quality Problems on Users, Classification of Mitigation Techniques for Power Quality Problems.</p> <p>Power Quality Standards and Monitoring: Introduction, State of the Art on Power Quality Standards and Monitoring, Power Quality Terminologies, Power Quality Definitions, Power Quality Standards, Power Quality Monitoring, Numerical Examples.</p> <p>Passive Shunt and Series Compensation: Introduction, State of the Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators, Modelling, Simulation, and Performance of Passive Shunt and Series Compensators, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Active Shunt Compensation: Introduction, State of the Art on DSTATCOMs, Classification of DSTATCOMs, Principle of Operation and Control of DSTATCOMs, Analysis and Design of DSTATCOMs, Modelling, Simulation, and Performance of DSTATCOMs, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Active Series Compensation: Introduction, State of the Art on Active Series Compensators, Classification of Active Series Compensators, Principle of Operation and Control of Active Series Compensators, Analysis and Design of Active Series Compensators, Modelling, Simulation, and Performance of Active Series Compensators, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
<p>Unified Power Quality Compensators: Introduction, State of the Art on Unified Power Quality Compensators, Classification of Unified Power Quality Compensators, Principle of Operation and Control of Unified Power Quality Compensators, Analysis and Design of Unified Power Quality Compensators, Modelling, Simulation, and Performance of UPQCs, Numerical Examples (from 6.01 to 6.10). ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)				
16EPE253 POWER QUALITY PROBLEMS AND MITIGATION (Elective Course) (continued)				
CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Unified Power Quality Compensators (continued): Numerical Examples (from 6.11 to 20). Loads That Cause Power Quality Problems: Introduction, State of the Art on Nonlinear Loads, Classification of Nonlinear Loads, Power Quality Problems Caused by Nonlinear Loads, Analysis of Nonlinear Loads, Modelling, Simulation, and Performance of Nonlinear Loads, Numerical Examples. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain causes, effects of PQ problems and classification of mitigation techniques for PQ problems. • Explain PQ standards, terminology and monitoring requirements through numerical problems. • Explain passive shunt and series compensation using lossless passive components. • Explain the design, operation and modeling of active shunt compensation equipment. • Explain the design, operation and modeling of active series compensation equipment. • Explain the design operation and modeling of unified power quality compensators. • Discuss mitigation of power quality problems due to nonlinear loads. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Modern Tool Usage, Engineers and society, Ethics, Individual and Team work, Communication, Lifelong Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Power Quality Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad	Wiley	2015

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II POWER ELECTRONIS LABORATORY-2			
Course Code	16EPEL26	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	40	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to assess the performance of separately excited DC motor fed by single phase and three phase fully controlled converter in continuous and discontinuous current modes. • To conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • To simulate different converters and analyze the waveform in continuous and discontinuous current modes. • To simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Sl. NO	Experiments		
1	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
2	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
3	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
4	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
5	Performance analysis of a practical chopper fed DC Drives system for class-A and class-C commutation and analysis of wave forms in continuous mode.		
6	Simulation study of buck, boost and buck- boost converter (basic topologies) and analysis of wave forms for continuous current mode (CCM).		
7	Simulation study of buck, boost and buck-boost converter (basic topologies) and analysis of wave forms for discontinuous current mode (DCM).		
8	Simulation study of forward converter and fly back converter and performance analysis of various wave forms.		
9	Resonant converter simulation study and analysis.		
10	Closed loop operation of a buck and boost converter.		
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ – Understanding L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Conduct experiments on single phase / three phase fully controlled converter fed separately excited DC motor to assess the performance in continuous and discontinuous current modes. • Conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • Simulate different converters for analyzing the waveform in continuous and discontinuous current modes. • Simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
SEMINAR			
Course Code	16EPE27	IA Marks	100
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contact Hours	--	Exam Marks	--
Credits - 01			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.</p> <p>Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The Internal Assessment marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman. ■</p>			
<p>Marks distribution for internal assessment of the course 16EPE27 seminar:</p> <p>Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks</p>			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

III SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE31	Seminar / Presentation on Internship. (After 8 weeks from the date of commencement)			--	25	--	25	20
2	16EPE32	Report on Internship	--	--	--	25	--	25	
3	16EPE33	Evaluation and Viva-Voce of Internship	--	--	--	--	50	50	
4	16EPE34	Evaluation of Project phase -1	--	--	--	50	--	50	1
TOTAL			--	--	--	100	50	150	21

Number of credits completed at the end of III semester: 22+ 22 + 21 = 65

Note:

Internship of 16 weeks shall be carried out during III semester.

Major part of the Project work shall also be carried out during the III semester in consultation with the Guide/s.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

IV SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE41	HVDC power Transmission	04	--	03	20	80	100	4
2	16EPE42X	Elective - 3	03	--	03	20	80	100	3
3	16EPE43	Evaluation of Project phase - 2	--	--	--	50	-	50	3
4	16EPE44	Evaluation of Project and Viva-Voce	--	--	--	--	100 + 100	200	10
TOTAL			07	--	06	90	360	450	20

Number of credits completed at the end of IV semester: 22 + 22 + 21 + 20 = 85

Elective - 3

Course Code under 16EPE42X	Title
16EPE421	Digital Power Electronics
16EPE422	MPPT in Solar Systems
16EPE423	Multi-Terminal DC Grids
16EPE424	Multilevel Converters for Industrial Applications

Note: 1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted

4. Project evaluation:

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - IV			
HVDC POWER TRANSMISSION (Core Course)			
Course Code	16EPE41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to DC power transmission and describe the basic components of a converter, and describe the methods for compensating the reactive power demanded by the converter and the methods for simulation of HVDC systems • To describe the types of filters for removing harmonics and the characteristics of the system impedance resulting from AC filter designs and different methods of control of HVDC converter and system. • To explain the design techniques for the main components of an HVDC system. • To explain the protection of HVDC system and other converter configurations used for the HVDC transmission and the recent trends for HVDC applications. ■ 			
Module-1			Teaching Hours
HVDC Technology: Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, Review of the HVDC System Reliability, HVDC Characteristics and Economic Aspects. Power Conversion: Thyristor, 3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Harmonics of HVDC and Removal: Introduction, Determination of Resulting Harmonic Impedance, Active Power Filter. Control of HVDC Converter and System: Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of HVDC Converter and System (continued): HVDC Control Functions, Reactive Power and Voltage Stability. Interactions between AC and DC Systems: Definition of Short Circuit Ratio and Effective Short Circuit Ratio, Interaction between HVDC and AC Power System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Main Circuit Design: Converter Circuit and Components, Converter Transformer, Cooling System, HVDC Overhead Line, HVDC Earth Electrodes, HVDC Cable, HVDC Telecommunications Current Sensors, HVDC Noise and Vibration. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Fault Behaviour and Protection of HVDC System: Valve Protection Functions, Protective Action of an HVDC System, Protection by Control Actions, Fault Analysis. Other Converter Configurations for HVDC Transmission: Introduction, Voltage Source Converter (VSC), CCC and CSCC HVDC System, 10.4 Multi-Terminal DC Transmission. Trends for HVDC Applications: Wind Farm Technology, Modern Voltage Source Converter (VSC) HVDC Systems, 800 kV HVDC System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE)
16EPE41 HVDC POWER TRANSMISSION (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain importance of DC power transmission.
- Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter
- Explain the methods for simulation of HVDC systems and its control.
- Describe filters for eliminating harmonics and the characteristics of the system impedance resulting from AC filter designs
- Explain the design techniques for the main components of an HVDC system.
- Explain the protection of HVDC system and other converter configurations used for the HVDC transmission.
- Explain the recent trends for HVDC applications. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis, Lifelong Learning.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text/Reference Books

1	HVDC Transmission: Power Conversion Applications in Power Systems	Chan-Ki Kim et al	Wiley	2009
2	Direct Current Transmission	E.W. Kimbark	Wiley	1971
3	High Voltage Direct Current Transmission	Arrilaga	IET	2 nd Edition, 1998
4	HVDC Transmission	S. Kamakshaiiah et al	Mc Graw Hill	2011
5	HVDC and FACTS Controllers; Applications of Static Converters in Power Systems	Vijay K Sood	BSP Books	2013
6	HVDC Power Transmission Systems	K. R. Padiyar	New Age International	2012

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Elective Course)			
Course Code	16EPE424	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To provide an overview of medium-voltage power converters and their applications. • To describe the generalized multilevel converter topology and to derive the classic converters with a common DC bus and to analyze the common characteristics of the symmetric topologies. • Explain the analysis of the operation of the diode-clamped multilevel converter, and a multilevel space vector modulation and to characterize the balancing boundary of the passive front-end converter • To describe the operation and analysis of the flying capacitor multilevel converter. • To explain asymmetric topology with hybrid modulation and a common DC source called a cascade asymmetric multilevel converter (CAMC) with five voltage levels and its advantages. • To analyse the behaviour of the CAMC as a distribution static compensator (DSTATCOM) and shunt active power filter in improving the power quality in medium-voltage distribution systems as custom power devices. • To analyse the behaviour of the diode-clamped topology configured as a back-to-back converter for several working conditions. ■ 			
Module-1			Teaching Hours
Converters: Introduction, Medium-Voltage Power Converters, Multilevel Converters, Applications. Multilevel Topologies: Introduction, Generalized Topology with a Common DC Bus, Converters Derived from the Generalized Topology, Symmetric Topologies without a Common DC Link, Summary of Symmetric Topologies, Asymmetric Topologies. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-2			
Diode-Clamped Multilevel Converter: Introduction, Converter Structure and Functional Description, Modulation of Multilevel Converters, Voltage Balance Control, Effectiveness Boundary of Voltage Balancing in DCMC Converters, Performance Results. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-3			
Flying Capacitor Multilevel Converter: Introduction, Flying Capacitor Topology, Modulation Scheme for the FCMC, Dynamic Voltage Balance of the FCMC. Cascade Asymmetric Multilevel Converter (CAMC): Introduction, General Characteristics of the CAMC, CAMC Three-Phase Inverter, Comparison of the Five-Level Topologies. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-4			
Case Study 1: DSTATCOM Built with a Cascade Asymmetric Multilevel Converter: Introduction, Compensation Principles, CAMC Model, Reactive Power and Harmonics Compensation. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-5			
Case Study 2: Medium-Voltage Motor Drive Built with DCMC: Introduction, Back-to-Back DCMC Converter, Unified Predictive Controller of the Back-to-Back DCMC in an IM Drive Application, Performance Evaluation. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		

M.TECH POWER ELECTRONICS (EPE)
16EPE424 MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Elective Course)
(continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain the working of medium-voltage power converters and their applications.
- Explain multilevel, symmetric and asymmetric topologies.
- Explain the structure and operation of the diode-clamped multilevel converter, and a multilevel space vector modulation.
- Characterize the balancing boundary of the passive front-end converter.
- Describe the operation and analysis of the flying capacitor multilevel converter.
- Discuss the characteristics topologies of the Cascade Asymmetric Multilevel Controller.
- Explain the working of a distribution static compensator (DSTATCOM) built with CAMC for reactive power and harmonic compensation.
- Evaluate the performance of back-to-back converter in an induction motor drive for several working conditions. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Multilevel Converters for Industrial Applications	Sergio Alberto González, Santiago Andrés Verne, María Inés Valla	CRC Press	2014
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VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus M.Tech POWER ELECTRONICS (EPE)

Eligibility: Bachelor's degree in Engineering or Technology in

- (a) Electrical and Electronics Engineering (b) Electronics and Communication Engineering
- (c) Electronics and Telecommunication Engineering (d) Telecommunication Engineering
- (e) Electronics and Instrumentation Engineering (f) Instrumentation Engineering
- (g) Biomedical Engineering (h) Medical Electronics (i) AMIE in appropriate branch
- (i) GATE: EC, IT, EE

(Effective from Academic year 2016-17)

**BOARD OF STUDIES IN ELECTRICAL AND ELECTRONICS ENGINEERING
December 2016**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
(Total number of credits prescribed for the programme - 85)

I SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EEE11	Applied Mathematics	04	--	03	20	80	100	4
2	16EPE12	Power Semiconductor Devices and Components	04	--	03	20	80	100	4
3	16EPE13	Power Electronic Converters	04	--	03	20	80	100	4
4	16EPE14	Modelling and Design of Controllers	04	--	03	20	80	100	4
5	16EPE15X	Elective -1	03	--	03	20	80	100	3
6	16EPEL16	Power Electronics Laboratory - 1	-	3	03	20	80	100	2
7	16EPE17	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of I semester: 22

Elective - 1

Course Code under 16EPE15X	Title
16EPE151	Embedded Systems
16EPE152	Power System Harmonics
16EPE153	Advanced Control Systems
16EPE154	EMC in Power Electronics

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(Total number of credits prescribed for the programme - 85)

II SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks		Total Marks
1	16EPE21	Electric Drives	04	--	03	20	80	100	4
2	16EPE22	Switched - Mode Power Supplies	04	--	03	20	80	100	4
3	16EPE23	Modelling and Analysis of Electrical Machines	04	--	03	20	80	100	4
4	16EPE24	FACTS Controllers	04	--	03	20	80	100	4
5	16EPE25X	Elective - 2	03	--	03	20	80	100	3
6	16EPEL26	Power Electronics Laboratory - 2	-	3	03	20	80	100	2
7	16EPE27	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of II semester: 22+ 22 = 44

Elective - 2

Course Code under 16EPE25X	Title
16EPE251	Converters for Solar and Wind Power Systems
16EPE252	Uninterruptible Power Supply
16EPE253	Power Quality Problems and Mitigation
16EPE254	Hybrid Electric Vehicles

Note: Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

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III SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE31	Seminar / Presentation on Internship. (After 8 weeks from the date of commencement)			--	25	--	25	20
2	16EPE32	Report on Internship	--	--	--	25	--	25	
3	16EPE33	Evaluation and Viva-Voce of Internship	--	--	--	--	50	50	
4	16EPE34	Evaluation of Project phase -1	--	--	--	50	--	50	1
TOTAL			--	--	--	100	50	150	21

Number of credits completed at the end of III semester: 22+ 22 + 21 = 65

Note:

Internship of 16 weeks shall be carried out during III semester.

Major part of the Project work shall also be carried out during the III semester in consultation with the Guide/s.

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SCHEME OF TEACHING AND EXAMINATION - 2016-17
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 (Total number of credits prescribed for the programme - 85)

IV SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE41	HVDC power Transmission	04	--	03	20	80	100	4
2	16EPE42X	Elective - 3	03	--	03	20	80	100	3
3	16EPE43	Evaluation of Project phase - 2	--	--	--	50	-	50	3
4	16EPE44	Evaluation of Project and Viva-Voce	--	--	--	--	100 + 100	200	10
TOTAL			07	--	06	90	360	450	20

Number of credits completed at the end of IV semester: 22 + 22 + 21 + 20 = 85

Elective - 3

Course Code under 16EPE42X	Title
16EPE421	Digital Power Electronics
16EPE422	MPPT in Solar Systems
16EPE423	Multi-Terminal DC Grids
16EPE424	Multilevel Converters for Industrial Applications

Note: 1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted

4. Project evaluation:

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
APPLIED MATHAMATICS (Core Course)			
Course Code	16EEE11	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> The objectives of this course is to acquaint the students with principles of advanced mathematics through linear algebra, transform methods for differential equations, calculus of variations and linear and non-linear programming, that serve as an essential tool for applications of electrical engineering sciences. ■ 			
Module-1			Teaching Hours
Numerical Methods: Solution of algebraic and transcendental equations- iterative methods based on second degree equation – Muller method(no derivation), Chebyshev method. Fixed point iteration method (first order), acceleration of convergence- Δ^2 - Aitken’s method. System of non-linear equations – Newton-Raphson method. Complex roots by Bairstow’s method. ■			10
Revised Bloom’s Taxonomy Level	L ₂ – Understanding, L ₃ – Applying		
Module-2			
Numerical Solution of Partial Differential Equations: Classification of second order equations, parabolic equations-solution of one dimensional heat equation, explicit method, Crank-Nicolson method. Hyperbolic equations- solution of one dimensional wave equation and two-dimensional Laplace equation by explicit method. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying		
Module-3			
Linear Algebra: Vector spaces, linear dependent, independence, basis and dimension, elementary properties, examples. Linear Transformations: Definition, properties, range and null space, rank and nullity, algebra of linear transformations-invertible, singular and non-singular transformations, representation of transformations by matrices. ■			10
Revised Bloom’s Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding		
Module-4			
System of linear algebraic equations and Eigen value problems: Iterative methods - Gauss-Seidal method, SOR method, Eigen value problems – Gerschgorian circle theorem, Eigen values and Eigen vectors of real symmetric matrices -Jacobi method. Interpolation: Hermite interpolation, spline interpolation, numerical solution of differential equations – Numerov method. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying		
Module-5			
Optimization: Linear programming- formulation of the problem, general linear programming problem, simplex method, artificial variable technique, Big M-method. Graph Theory: Basic terminologies, types of graphs, sub graphs, graphs isomorphism, connected graphs-walks, paths, circuits, connected and disconnected graphs, operations on graphs, Eulerian paths and circuits, Hamiltonian paths and circuits, applications to electrical circuits. ■			10
Revised Bloom’s Taxonomy Level	L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)
16EEE11 APPLIED MATHAMATICS (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

1. Employ numerical techniques in order to achieve more accurate values in the computation of roots of algebraic and non-linear equations.
2. Utilize analytical and numerical schemes to solve partial differential equations applicable to engineering problems.
3. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
4. Apply standard iterative methods to compute Eigen values and solve ordinary differential equations.
5. Employ linear and non-linear programming techniques in simulation of network systems and optimization of electrical circuits. ■

Graduate Attributes (As per NBA):

Critical Thinking, Problem Solving, Research Skill, Usage of Modern Tools.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Text/Reference Books

1	Linear Algebra and its Applications	David C.Lay et al	Pearson	5th Edition,2015
2	Numerical methods in Engineering and Science (with C, C++ & MATLAB)	B.S.Grewal	Khanna Publishers	2014
3	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	PHI	2012
4	Numerical Methods for Scientific and Engineering Computation	M. K. Jain et al	New Age International	9 th Edition, 2014
5	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	43 rd Edition,2015
6	Linear Algebra	K.Hoffman et al	PHI	2011
7	Web links: 1. http://nptel.ac.in/courses.php?disciplineId=111 2. http://www.class-central.com/Course/math(MOOCs) 3. www.wolfram.com			

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
POWER SEMICONDUCTOR DEVICES AND COMPONENTS (Core Course)			
Course Code	16EPE12	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To enhance the knowledge of fundamentals of semiconductor physics, power electronics and power computation in circuits • To enhance the knowledge of fundamentals of various semiconductor devices, their operation and characteristics. • To explain the design and operation of drive circuits and snubber circuits. • To explain the controlling of temperature rise of the semiconductor devices and designing of magnetic components used for the power electronic circuits. ■ 			
Module-1			Teaching Hours
<p>Power Electronics: Introduction, Converter Classification, Power Electronics Concepts, Electronic Switches, Switch Selection, Spice, PSpice and Capture, Representation of switches in Pspice -The Voltage-Controlled Switch, Transistors, Diodes and Thyristors (SCRs).</p> <p>Power Computations: Introduction, Power and Energy, Inductors and Capacitors, Energy Recovery, Effective Values, Apparent Power and Power Factor, Power Computations for Sinusoidal AC Circuits, Power Computations for Nonsinusoidal Periodic Waveforms, Power Computations Using Pspice.</p> <p>Basic Semiconductor Physics: Introduction, Conduction Processes in Semiconductors pn Junctions, Charge Control Description of pn-Junction Operation, Avalanche Breakdown. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Power Diodes: Introduction, Basic Structure and I – V characteristics, Breakdown Voltage Considerations, On –State Losses, Switching Characteristics, Schottky Diodes.</p> <p>Bipolar Junction Transistors: Introduction, Vertical Power Transistor Structures, Z-V Characteristics, Physics of BJT Operation, Switching Characteristics, Breakdown Voltages, Second Breakdown, On-State Losses, Safe Operating areas.</p> <p>Power MOSFETs : Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Operating Limitations and Safe Operating Areas. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Thyristors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Methods of Improving di/dt and dv/dt Ratings.</p> <p>Gate Turn-Off Thyristors: Introduction, Basic Structure and Z-V Characteristics, Physics of Turn-Off Operation, GTO Switching Characteristics, Overcurrent Protection of GTOs.</p> <p>Insulated Gate Bipolar Transistors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Latchup in IGBTs, Switching Characteristics, Device Limits and SOAs.</p> <p>Emerging Devices and Circuits: Introduction, Power Junction Field Effect Transistors, Field-Controlled Thyristor, JFET-Based Devices versus Other Power Devices, MOS-Controlled Thyristors, Power Integrated Circuits, New Semiconductor Materials for Power Devices. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) 16EPE12 POWER SEMICONDUCTOR DEVICES AND COMPONENTS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
<p>Snubber Circuits: Function and Types of Snubber Circuits, Diode Snubbers, Snubber Circuits for Thyristors, Need for Snubbers with Transistors, Turn-Off Snubber, Overvoltage Snubber, Turn-On Snubber, Snubbers for Bridge Circuit Configurations, GTO Snubber Considerations.</p> <p>Gate and Base Drive Circuits: Preliminary Design Considerations, dc-Coupled Drive Circuits, Electrically Isolated Drive Circuits, Cascode-Connected Drive Circuits, Thyristor Drive Circuits, Power Device Protection in Drive Circuits, Circuit Layout Considerations ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
<p>Component Temperature Control and Heat Sinks: Control of Semiconductor Device Temperatures, Heat Transfer by Conduction, Heat sinks, Heat Transfer by Radiation and Convection.</p> <p>Design of Magnetic Components: Magnetic Materials and Cores, Copper Windings, Thermal Considerations, Analysis of a Specific Inductor Design, Inductor Design Procedures, Analysis of a Specific Transformer Design, Eddy Currents, Transformer Leakage Inductance, Transformer Design Procedure, Comparison of Transformer and Inductor Sizes. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss power electronic concepts, electronic switches and semiconductor physics. • Explain representation of switches in P-spice and power computations. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; power diodes, power BJT, power MOSFET. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; thyristors, power IGBT, power FET. • Design Snubber circuits for the protection of power semiconductor devices. • Design gate and base drive circuits for power semiconductor devices • Design a heat sink to control the temperature rise of semiconductor devices • Design magnetic components inductors and transformers used in the power electronic circuits. ■ 				
Graduate Attributes (As per NBA):				
Engineering Knowledge Problem, Analysis, Design / development of solutions, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics	Daniel W Hart	McGraw Hill	
2	Power Electronics Converters, Applications, and Design	Ned Mohan et al	Wiley	3 rd Edition, 2014
3	Semiconductor Device Modeling with Spice	G. Massobrio, P. Antognetti	McGraw-Hill	2 nd Edition, 2010
4	Power Semiconductor Devices	B. Jayant Baliga	Springer	2008

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I			
POWER ELECTRONIC CONVERTERS (Core Course)			
Course Code	16EPE13	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of PWM techniques in controlling the converter operation. • To impart knowledge of designing and analyzing DC – DC PWM converters and control modules. • To impart knowledge of designing and analyzing DC – AC and AC – DC converters. • To impart knowledge of analyzing different types of resonant converters and their control. • To impart knowledge of AC –AC converters and multilevel controllers. ■ 			
Module-1			Teaching Hours
PWM DC/DC Converters: Forward Converters - Analysis of the Basic Circuit, Galvanically Isolated Forward Converter, Boost Converter - Analysis of the Basic Scheme, Variation of the Output Voltage, Boundary Between the Continuous and the Discontinuous Mode , Discontinuous Mode Power Losses, Indirect Converter - Boundary Between the Continuous and the Discontinuous Mode, Discontinuous Mode, Indirect Converter with Galvanic Separation, Push – Pull (Symmetric) Converters - Analysis of Idealized Circuit in Continuous Mode, Output Characteristics, Selection of Components, DC Premagnetization of the Core, Half-Bridge Converter, Bridge Converter, Hamilton Circuit, Ćuk Converters - Elimination of the Current Ripple, Ćuk Converters with Galvanic Isolation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Control Modules: Basic Principles and Characteristics of PWM Control Modules - Circuit Analysis, Simple PWM, Voltage-Controlled PWM, Current-Controlled PWM- Compensated PWM, IC Control Modules - Control Module TL494, Control Module SG1524/2524/3524, Control Module TDA 1060. DC/AC Converters – Inverters: Single-Phase Voltage Inverters - Pulse-Controlled Output Voltage, Pulse-Width Modulated Inverters - Unipolar PWM, Three-Phase Inverters-Overmodulation ($m_a > 1$), Asynchronous PWM, Space Vector Modulation - Space Vector Modulation: Basic Principles, Application of Space Vector Modulation Technique, Direct and Inverse Sequencing, Real Drive Influence. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
AC/DC Converters – Rectifiers: Half-Wave Single-Phase Rectifiers , Full-Wave Rectifiers - Commutation of Current, Output Filters - Capacitive Filter, L Filter, Voltage Doublers, Three-Phase Rectifiers, Phase Controlled Rectifiers - Full-Wave Thyristor Rectifiers, Three-Phase Thyristor Bridge Rectifiers, Twelve-Pulse Rectifiers, Rectifiers with Circuit for Power Factor Correction, Active Rectifier - Active Rectifier with Hysteresis Current Controller, PWM Rectifiers - Advanced Control Techniques of PWM Rectifiers , PWM Rectifier with Current Output, PWM Rectifiers in Active Filters, Some Topologies of PWM Rectifiers, Applications of PWM Rectifiers. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

M.TECH POWER ELECTRONICS (EPE) 16EPE13 POWER ELECTRONIC CONVERTERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
Resonant Converters: Resonant Circuits - Resonant Converters of Class D, Series Resonant Converters, Parallel Resonant Converters, Series – Parallel Resonant Converter, Series Resonant Converters Based on GTO Thyristors, Class E Resonant Converters, DC/DC Converters Based on Resonant Switches - ZCS Quasi-resonant Converters, ZVS Quasi-resonant Converters, Multiresonant Converters, ZVS Resonant DC/AC Converters, Soft Switching PWM DC/DC Converters -Phase Shift Bridge Converters, Resonant Transitions PWM Converters, Control Circuits of Resonant Converters - Integrated Circuit Family UCx861-8, Integrated Circuits for Control of Soft, Switching PWM Converters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
AC/AC Converters: Single-Phase AC/AC Voltage Converters - Time Proportional Control Three-Phase Converters, Frequency Converters, Direct Frequency Converters, Introduction to AC/AC Matrix Converters - Basic Characteristics, Bidirectional Switches, Realization of Input Filter, Current Commutation, Protection of Matrix Converter, Application of Matrix Converter. Introduction to Multilevel Converters: Basic Characteristics -Multilevel DC/DC Converters, Time Interval: $nT < t < nT + DT$, $n = 0, 1, 2$, Time Interval: $nT + DT < t < (n + 1)T$, Multilevel Inverters - Cascaded H-Bridge Inverters, Diode-Clamped Multilevel Inverters, Flying Capacitor Multilevel Inverter, Other Multilevel Inverter Topologies, Control of Multilevel Inverters - Multilevel SPWM, Space Vector Modulation, Space Vector Control, Selective Harmonic Elimination. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Use the knowledge of PWM techniques in controlling different power electronic converters. • Apply the knowledge of power electronics in design and analysis of DC –DC PWM converters. • Design and analyze DC –AC and AC – DC converters and control their operation using PWM techniques. • Design and analyze different resonant converters and their control circuits. • Analyze AC – AC converters and multilevel converters. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters and Regulators	Branko L. Doki ć Branko Blanu š a	Springer (International Publishing, Switzerland)	3 rd Edition, 2015
2	Power Electronics Converters, Applications, and Design	Ned Mohan et al	Wiley	3 rd Edition, 2014

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I			
MODELLING AND DESIGN OF CONTROLLERS (Core Course)			
Course Code	16EPE14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge required for modeling and computer simulation of power electronic converters and systems. • To explain control system essentials in representing system in digital domain. • To explain the designing of digital controllers by different methods. • To explain the design and analysis of optimal and robust controllers by different methods. • To impart knowledge of discrete computation essentials. ■ 			
Module-1			Teaching Hours
Computer Simulation of Power Electronic Converters and Systems: Introduction, Challenges in Computer Simulation, Simulation Process, Mechanics of Simulation, Solution Techniques for Time-Domain Analysis, Widely Used, Circuit-Oriented Simulators, Equation Solvers. Modelling of Systems: Input-Output relations, Differential Equations and Linearization, State Space Representation, Transfer Function Representation, Block Diagrams, Lagrange method, Circuit Averaging, Bond Graphs, Space Vector Modelling. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Control System Essentials: Representation of system in digital Domain, The Z – Transform, Digital Filter, Mapping between s – plane and z – plane, Effect of Sampling, Continuous to Discrete Domain Conversion, Control System Basics, Control Principles, State - Space Method. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Digital Controller Design: Controller Design Techniques, Bode Diagram Method, PID Controller, Root Locus Method, State Space Method, Full State Feedback, Regulator Design by Pole Placement, Estimation Design, Tracker : Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Digital Controller Design (continued): Controlling Voltage, Controlling Current, Control of Induction motor, Output Feedback, Induction motor Control with Output Feedback. Optimal and Robust Controller Design: Least Squares Principle, Quadratic Forms, Minimum Energy Principle, Least Square Solution, Weighted Least Squares, Recursive Least Squares, Optimal Control: Linear Quadratic, Induction motor example, Robust Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) 16EPE14 MODELLING AND DESIGN OF CONTROLLERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Discrete Computation Essentials: Numeric Formats, Tracking the Base Point in the Fixed Point System, Normalization And Scaling, Arithmetic Algorithms. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Describe the role of computer simulations in the analysis and design of power electronics systems. • Understand the functional modeling of static systems. • Use sampling technique to determine a digital equivalent to a continuous time system. • Understand the control basics of digital systems. • Design digital controllers in discrete time and frequency domain. • Design optimal and robust controllers by different methods. • Explain essentials of discrete computation. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, William P. Robbins	Wiley	3 rd Edition,2014
2	Power Electronics Essentials and Applications	L.Umanand	Wiley	1 st Edition,2014

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - I			
EMBEDDED SYSTEMS (Elective Course)			
Course Code	16EPE151	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of embedded systems with suitable examples, explanation of process, classification of embedded systems. • To explain the processor architecture, memory organization, communication with processor and interrupt services. • To explain the program modeling concepts, inter-process communication and synchronization of processes. ■ 			
Module-1			Teaching Hours
Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems – on –chip (Soc) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design of Process in Embedded System, Formulation of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skill required for an Embedded System Designer. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Processor Architecture and Memory Organisation: 8051 Architecture, Real world Interfacing, Introduction to Advanced Architecture, Processor and Memory Organization, Instruction Level Parallelism, Performance Metrics, Memory – Types, Memory – Maps and Addresses, Processor Selection, Memory Selection. ■			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Devices and Communication Buses, Interrupt Services: IO Types and Examples, Serial Communication Devices, Parallel Device Ports, Sophisticated Interfacing Features in Device Ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Serial Bus Device Protocols – Parallel Communication Network Using ISA, PCI, PCI –X and Advanced Protocols.			08
Device Drivers and Interrupts Service Mechanisms: Programmed – I/O Busy – wait Approach without Interrupt Service Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing Mechanism, Direct Memory Access. ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Program Modelling concepts: Program Models, DFG Models, State Machine Programming Models for Event – controlled Program Flow, Modelling of Multiprocessor Systems, UML Modelling.			08
Interprocess Communication and Synchronization of Processes, Threads and Tasks: Multiple Processes in an Application, Multiple Threads in an Application, Tasks, Task Status, Task and Data, Clear – cut Distention Between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Interprocess Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions. ■			
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) 16EPE151 EMBEDDED SYSTEMS (Elective Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Real - Time Operating Systems: OS Services, Process Management, Timer Functions, Event Functions, Memory management, Device, File and IO Subsystems Management , Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real – time Operating Systems, Basic Design Using an RTOS, Rtos Task Scheduling Models, Interrupt Latency and Response of the task as performance Metrics, OS Security Issues. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain design process in embedded system and formulation of system design. • Describe processor architecture and memory organization. • Describe the devices; serial port, parallel port devices, timing devices, devices for synchronous iso-synchronous and asynchronous communication. • Describe device drivers and interrupt mechanisms. • Explain the programming concepts and source code engineering tools for embedded programming. • Explain real time programming and program modeling concepts during single and multi-processor system software development process. • Describe real time operating systems concepts. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Embedded Systems: Architecture, Programming and Design	Raj Kamal	Mc Graw Hill	2 nd Edition,2014

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I POWER ELECTRONICS LABORATORY-1			
Course Code	16PEEL16	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	40	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiment on various power electronic devices to analyze their static and dynamic characteristics. • To conduct experiments and enhance understanding of different power electronic converters. ■ 			
Sl. NO	Experiments		
1	Analysis of static and dynamic characteristic of MOSFET and IGBT.		
2	Performance of single phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
3	Performance of single phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
4	Study of effect of source inductance on the performance of single phase fully controlled converter.		
5	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
6	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
7	Performance analysis of single phase bridge inverter for RL load and voltage control by single pulse width modulation.		
8	Performance analysis of two quadrant chopper.		
9	Diode clamped multilevel inverter.		
10	ZVS operation of a Synchronous buck converter.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Analyze the static and dynamic characteristics of various semiconductor devices. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for continuous current modes. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for discontinuous current modes. • Assess the performance of single phase bridge inverter for RL load and control the voltage by pulse width modulation. • Apply the knowledge of power electronics in performance analysis of chopper and synchronous buck converter. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - I SEMINAR			
Course Code	16EPE17	IA Marks	100
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contact Hours	--	Exam Marks	--
Credits - 01			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The Internal Assessment marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman. ■</p>			
<p>Marks distribution for internal assessment of the course 16EPE17 seminar: Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks</p>			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

*** END ***

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
(Total number of credits prescribed for the programme - 85)

II SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination			Credits	
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks		Total Marks
1	16EPE21	Electric Drives	04	--	03	20	80	100	4
2	16EPE22	Switched - Mode Power Supplies	04	--	03	20	80	100	4
3	16EPE23	Modelling and Analysis of Electrical Machines	04	--	03	20	80	100	4
4	16EPE24	FACTS Controllers	04	--	03	20	80	100	4
5	16EPE25X	Elective - 2	03	--	03	20	80	100	3
6	16EPEL26	Power Electronics Laboratory - 2	-	3	03	20	80	100	2
7	16EPE27	Seminar	-	3	-	100	-	100	1
TOTAL			19	06	18	220	480	700	22

Number of credits completed at the end of II semester: 22+ 22 = 44

Elective - 2

Course Code under 16EPE25X	Title
16EPE251	Converters for Solar and Wind Power Systems
16EPE252	Uninterruptible Power Supply
16EPE253	Power Quality Problems and Mitigation
16EPE254	Hybrid Electric Vehicles

Note: Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
ELECTRIC DRIVES (Core Course)			
Course Code	16EPE21	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to drive, their characteristics and breaking. • To explain the basic elements of drives, classification of drives, their dynamics and speed control • To explain selection of drive for a specific application. • To explain control of an electric drive using microprocessor. ■ 			
Module-1			Teaching Hours
Characteristics Electric motors: Introduction, Characteristics of DC motors, Three phase Induction Motors and Synchronous Motors, Braking of Electric Motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Dynamics of Electric Drives: Introduction, Classification of Electric Drives, Basic Elements of an Electric Drive, Dynamic Conditions of Drive System, Stability Considerations of Electric Drive. Control of Electric Motors: Induction Motor Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of Electric Motors (continued): Synchronous Motor Drives, DC Drives. Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Control of Electric Motors (continued): Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. Applications: Drive Considerations for Textile Mills, Steel Rolling Mills, Cranes and Hoist Drives, Cement Mills, Sugar Mills, Machine Tools, Paper Mills, Coal Mines, Centrifugal Pumps, Turbo - compressors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Microprocessors and Control of Electrical Drives: Introduction, Dedicated Hardware Systems versus Microprocessor Control, Applications Area and Functions of Microprocessors in Drive Technology, Control of Electric Drives using Microprocessors, Control System Design of Microprocessors based Variable Speed Drives, Stepper motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE)
16EPE21 ELECTRIC DRIVES (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain characteristics of DC motors, induction motors and synchronous motors.
- Explain braking of electric motors.
- Classify electric drives.
- Discuss dynamics conditions and stability considerations of Electric drive.
- Control the speed of electric motors.
- Suggest a drive for a specific application.
- Explain using microprocessor in the control of an electric drive. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Electric Drives Concepts and Applications	Vedam Subrahmanyam	Mc Graw Hill	2 nd Edition, 2016
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M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
SWITCHED - MODE POWER SUPPLIES (Core Course)			
Course Code	16EPE22	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview on SMPS, its characteristics, new technologies, basic principles and control modes. • To introduce the topology of DC/DC converter used and the method of selecting key peripheral components of SMPS. • To explain the power factor correction circuit design of SMPS, the design of high-frequency transformer, the examples of SMPS optimization design, and the key design points of SMPS. • To introduce the SMPS testing technology and the protection circuit design of SMPS. ■ 			
Module-1			Teaching Hours
<p>Switching-Mode Power Supply (SMPS): Overview, Classification of Integrated Regulated Power Supply, Characteristics of SMPS, New Development Trend of SMPS, Basic Principles of SMPS, Control Mode Type of SMPS, Working Mode of SMPS, Feedback Type of SMPS, Load Characteristics of SMPS.</p> <p>Topologies of the DC/DC Converter: Topologies of the DC/DC Converter, Basic Principle of Buck Converter, Basic Principle of - Boost Converter, Buck-Boost Converter, Charge Pump Converter, (Single-ended primary inductor converter)SEPIC, Flyback Converter, Forward Converter, Push-Pull Converter, Half/Full Bridge Converter, Soft Switching Converter, Half-Bridge LLC Resonant Converter, 2-Switch Forward Converter. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Method for Selecting Key Peripheral Components of SMPS: Selection Method for - Fixed Resistor, Capacitors, Inductor Characteristics and Selection Method for Magnetic Beads, Selection Method for EMI Filter - Input Bridge Rectifier, Output Rectifier, Transient Voltage Suppressor (TVS), Power Switching Tube, Optical Coupler, Adjustable Precision Shunt Regulator, SMPS Protection Elements. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Power Factor Correction Circuit Design of SMPS: Brief Introduction to Power Factor Correction (PFC), Basic Principle of Passive PFC Circuit, Design Examples of Passive PFC Circuit, Basic Principle of Active PFC Circuit, Design Examples of Active PFC Circuit, Principle and Application of High-Power PFC, Measures to Suppress PFC Electromagnetic Interference, PFC Configuration Scheme.</p> <p>Design of High-Frequency Transformer: Selection Method for Magnetic Cores by the Empirical Formula or Output Power Table, Waveform Parameters of the High-Frequency Transformer Circuit, Formula Derivation of Selecting High-Frequency Transformer Magnetic Core Based on AP Method, Design of Flyback High-Frequency Transformer, Design of Forward High-Frequency Transformer, Loss of High-Frequency Transformer. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ – Applying.		

M.TECH POWER ELECTRONICS (EPE) 16EPE22 SWITCHED - MODE POWER SUPPLIES (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4				Teaching Hours
<p>Key Design Points of SMPS: SMPS Design Requirements, Design of High-Efficiency SMPS, Methods of Reducing No-Load and Standby Power Consumption of SMPS, Stability Design of Optocoupler Feedback Control Loop SMPS Layout and Wiring, Design of Constant Voltage/Current SMPS, Design of Precision Constant Voltage/Current SMPS, Design of Remote Turn-Off Circuit for SMPS, Typical Application and Printed Circuit Design of New Single-Chip SMPS, Electromagnetic Interference Waveform Analysis and Safety Code Design of SMPS, Radiator Design of Single-Chip SMPS, Radiator Design of Power Switching Tube (MOSFET), Common Troubleshooting Methods of SMPS. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.			
Module-5				
<p>SMPS Testing Technology: Parameter Testing of SMPS, Performance Testing of SMPS, SMPS Measurement Skills, Accurate Measurement Method of Duty Ratio, Method to Detect the Magnetic Saturation of High-Frequency Transformer with Oscilloscope, Digital Online Current/Resistance Meter, Electromagnetic Compatibility Measurement of SMPS, Waveform Test and Analysis of SMPS.</p> <p>Protection and Monitoring Circuit Design of SMPS: Design of Drain Clamp Protection Circuit, Overvoltage Protection Circuit Constituted by Discrete Components, Application of Integrated Overvoltage Protector, Design of Undervoltage Protection Circuit, Design of Overcurrent and Overpower Protection Circuit, Design of Soft-Start Circuit, Mains Voltage Monitor, Transient Interference and Audio Noise Suppression Technology of SMPS, Design of Overheating Protection Component and Cooling Control System. ■</p>				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes:				
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Explain a SMPS, its characteristics, new technologies, basic principles and control modes. • Suggest a suitable DC/DC converter for an SMPS. • Explain the method of selecting key peripheral components of SMPS. • Design the power factor correction circuit of SMPS. • Explain selection of magnetic core and designing of high-frequency transformer. • Explain designing of different SMPS. • Explain testing technology of SMPS. • Design protection and monitoring circuit for SMPS. ■ 				
Graduate Attributes (As per NBA):				
Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics, Communication.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Optimal Design of Switching Power Supply	Zhanyou Sha et al	Wiley	2015

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Core Course)			
Subject Code	16EPE23	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To provide basic concepts of modelling of dc and ac machines. • To provide knowledge of theory of transformation of three phase variable to two phase variable. • To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modelling. • To provide modeling concepts of single phase and three phase transformers. • To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modelling. ■ 			
Module-1			Teaching Hours
<p>Basic Concepts of Modelling: Basic two pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bar and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations.</p> <p>DC Machine Modelling: Mathematical model of separately excited DC motor-steady state and transient state analysis, sudden application of inertia load, transfer function of separately excited DC motor, mathematical model of dc series motor, shunt motor, linearization techniques for small perturbations. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Reference Frame Theory: Real time model of a two phase induction machine, transformation to obtain constant matrices, three phase to two phase transformation, power equivalence.</p> <p>Dynamic Modelling of Three Phase Induction Machine: Generalized model in arbitrary frame, electromagnetic torque, deviation of commonly used induction motor models-stator reference frames model, rotor reference frames model, synchronously rotating reference frames model, equations in flux linkages, per unit model, dynamic simulation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Small Signal Equations of the Induction Machine: Derivation of small signal equations of induction machine, space phasor model, DQ flux linkages model derivation, control principle of the induction motor.</p> <p>Transformer Modelling: Introduction, single phase transformer model, three phase transformer connections, per phase analysis, normal systems, per unit normalization, per unit three phase quantities, change of base, per unit analysis of normal system, regulating transformers for voltage and phase angle control, auto transformers, transmission line and transformers. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
<p>Modelling of Synchronous Machines: Introduction, voltage equations and torque equation in machine variables, stator voltage equations in arbitrary and rotor reference frame variables, Park's equations, torque equations in substitute variables, rotor angle and angle between rotors, per unit system, analysis of steady state operation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)				
16EPE23 MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Core Course) (continued)				
CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Dynamic Analysis of Synchronous Machines: Dynamic performance during sudden change in input torque and during a 3-phase fault at the machine terminals, approximate transient torque versus rotor angle characteristics, comparison of actual and approximate transient torque-angle characteristics during a sudden change in input torque; first swing transient stability limit, comparison of actual and approximate transient torque-angle characteristics during a 3-phase fault at the machine terminals, critical clearing time, equal area criterion, computer simulation. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain the basic concepts of modeling. • Develop mathematical models for DC motors for transient state analysis. • Use reference frame theory to transform three phase to two phase. • Develop dynamic model for three phase induction motor in stator and rotor reference frames. • Develop mathematical model of single phase transformers. • Model synchronous machine using Park's transformation for the analysis of steady state operation. • Model synchronous machine to perform dynamic analysis under different conditions. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Ethics,				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Generalized Theory of Electrical Machines	P.S.Bimbra	Khanna Publications	5th Edition, 1995
2	Electric Motor Drives - Modelling, Analysis & Control	R. Krishnan	PHI Learning Private Ltd	Indian Edition, 2009
3	Analysis of Electrical Machinery and Drive Systems	P.C.Krause, et al	Wiley	2nd Edition, 2010
4	Power System Analysis	Arthur R Bergen and Vijay Vittal	Pearson	2 nd Edition, 2009
5	Power System Stability and Control	Prabha Kundur	Mc Graw Hill	1 st Edition, 1994
6	Dynamic Simulation of Electric Machinery using Matlab / Simulink	Chee-Mun Ong	Prentice Hall	1998

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - II			
FACTS CONTROLLERS (Core Course)			
Course Code	16EPE24	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To discuss the growth of complex electrical power networks and to introduce the lack of controllability of the active- and reactive-power flows in energized networks. • To describe the conventional controlled systems and introduce the basic operating principles of new FACTS devices • To describe the various components of a general SVC, its control system, an overview of the voltage-control characteristics of SVC and the principles of design of the SVC voltage regulator. • To explain the concepts of SVC control in such applications as stability enhancement, damping subsynchronous oscillations, improvement of HVDC link performance and the basic issues relating to the design of SVC controllers in different applications. • To explain the concepts of series compensation, TCSC controller and its operation, characteristics, modeling and applications. • To introduce voltage source converter based facts devices. ■ 			
Module-1			Teaching Hours
Control Mechanism of Transmission System: Background, Electrical Transmission Networks, Conventional Control Mechanisms, Flexible ac Transmission Systems (FACTS), Emerging Transmission Networks. Reactive-Power Control in Electrical Power Transmission Systems: Reactive Power, Uncompensated Transmission Lines, Passive Compensation. Principles of Conventional Reactive-Power Compensators: Introduction, Synchronous Condensers, The Saturated Reactor (SR), The Thyristor-Controlled Reactor (TCR), The Thyristor-Controlled Transformer (TCT). ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Principles of Conventional Reactive-Power Compensators (continued): The Fixed Capacitor–Thyristor-Controlled Reactor (FC–TCR), The Mechanically Switched Capacitor–Thyristor-Controlled Reactor (MSC–TCR), The Thyristor-Switched Capacitor (TSC), The Thyristor-Switched Capacitor–Thyristor-Controlled Reactor (TSC–TCR), A Comparison of Different SVCs. SVC Voltage Control: Introduction Voltage Control. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
SVC Voltage Control (continued): Effect of Network Resonances on the Controller Response, The 2nd Harmonic Interaction between the SVC and ac Network, Application of the SVC to Series-Compensated ac Systems, 3rd Harmonic Distortion, Voltage-Controller Design Studies. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
SVC Applications: Introduction, Increase in Steady-State Power-Transfer Capacity, Enhancement of Transient Stability, Augmentation of Power-System Damping - Principle of the SVC, Auxiliary Control, Torque Contributions of SVC Controllers, Effect of the Power System, Effect of the SVC, SVC Mitigation of Subsynchronous Resonance (SSR) - Principle of SVC Control, Configuration and Design of the SVC Controller, Rating of an SVC, Prevention of Voltage Instability- Principles of SVC Control- A Case Study, Configuration and Design of the SVC Controller, Rating of an SVC.			10

M.TECH POWER ELECTRONICS (EPE) 16EPE24 FACTS CONTROLLERS (Core Course) (continued) CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-4 (continued)				Teaching Hours
The Thyristor-Controlled Series Capacitor (TCSC): Series Compensation, The TCSC Controller, Operation of the TCSC, The TSSC, Analysis of the TCSC, Capability Characteristics, Harmonic Performance, Losses, Response of the TCSC, Modelling of the TCSC. ■				
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Module-5				
TCSC Applications: Introduction, Open-Loop Control, Closed-Loop Control, Improvement of the System-Stability Limit, Enhancement of System Damping, Subsynchronous Resonance (SSR) Mitigation, Voltage-Collapse Prevention. VSC based FACTS Controllers: Introduction, The STATCOM, The SSSC, The UPFC, Comparative Evaluation of Different FACTS Controllers. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Discuss the growth of complex electrical power networks, the lack of controllability of the active- and reactive-power flows in energized networks. • Describe the conventional controlled systems and the basic operating principles of FACTS. • Describe the various components of a general SVC, its control system, control characteristics and the design of the SVC voltage regulator. • Explain the use of SVC in stability enhancement, damping subsynchronous oscillations, improvement of HVDC link performance. • Explain the concepts of series compensation, TCSC controller and its operation, characteristics, modeling and applications. • Explain the operation of voltage source converter based FACTS. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Lifelong Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Thyristor-Based FACTS Controllers for Electrical Transmission Systems	R. Mohan Mathur Rajiv K. Varma	Wiley	2002
2	Understanding FACTS : concepts and technology of flexible AC Transmission systems	Narain G. Hingorani Laszlo Gyugyi.	Wiley	2000
3	Facts Controllers in Power Transmission and Distribution	K. R. Padiyar	New Age International	2007

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
POWER QUALITY PROBLEMS AND MITIGATION (Elective Course)			
Course Code	16EPE253	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction on power quality (PQ), causes and effects of PQ problems, requirement of PQ improvements, and mitigation aspects of PQ problems. • To give PQ definitions, terminologies, standards, benchmarks, monitoring requirements through numerical problems. • To explain passive shunt and series compensation using lossless passive LC components, active shunt compensation using DSTATCOM (distribution static compensators), active series compensation using DVR (dynamic voltage restorer), and combined compensation using UPQC (unified power quality compensator) for mitigation of current-based PQ problems. • To explain classification, modeling and analysis of various nonlinear loads which cause the power quality problems. ■ 			
Module-1			Teaching Hours
<p>Power Quality: Introduction, State of the Art on Power Quality, Classification of Power Quality Problems, Causes of Power Quality Problems, Effects of Power Quality Problems on Users, Classification of Mitigation Techniques for Power Quality Problems.</p> <p>Power Quality Standards and Monitoring: Introduction, State of the Art on Power Quality Standards and Monitoring, Power Quality Terminologies, Power Quality Definitions, Power Quality Standards, Power Quality Monitoring, Numerical Examples.</p> <p>Passive Shunt and Series Compensation: Introduction, State of the Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators, Modelling, Simulation, and Performance of Passive Shunt and Series Compensators, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Active Shunt Compensation: Introduction, State of the Art on DSTATCOMs, Classification of DSTATCOMs, Principle of Operation and Control of DSTATCOMs, Analysis and Design of DSTATCOMs, Modelling, Simulation, and Performance of DSTATCOMs, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Active Series Compensation: Introduction, State of the Art on Active Series Compensators, Classification of Active Series Compensators, Principle of Operation and Control of Active Series Compensators, Analysis and Design of Active Series Compensators, Modelling, Simulation, and Performance of Active Series Compensators, Numerical Examples. ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
<p>Unified Power Quality Compensators: Introduction, State of the Art on Unified Power Quality Compensators, Classification of Unified Power Quality Compensators, Principle of Operation and Control of Unified Power Quality Compensators, Analysis and Design of Unified Power Quality Compensators, Modelling, Simulation, and Performance of UPQCs, Numerical Examples (from 6.01 to 6.10). ■</p>			08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE)				
16EPE253 POWER QUALITY PROBLEMS AND MITIGATION (Elective Course) (continued)				
CHOICE BASED CREDIT SYSTEM (CBCS)				
Module-5				Teaching Hours
Unified Power Quality Compensators (continued): Numerical Examples (from 6.11 to 20). Loads That Cause Power Quality Problems: Introduction, State of the Art on Nonlinear Loads, Classification of Nonlinear Loads, Power Quality Problems Caused by Nonlinear Loads, Analysis of Nonlinear Loads, Modelling, Simulation, and Performance of Nonlinear Loads, Numerical Examples. ■				08
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> • Explain causes, effects of PQ problems and classification of mitigation techniques for PQ problems. • Explain PQ standards, terminology and monitoring requirements through numerical problems. • Explain passive shunt and series compensation using lossless passive components. • Explain the design, operation and modeling of active shunt compensation equipment. • Explain the design, operation and modeling of active series compensation equipment. • Explain the design operation and modeling of unified power quality compensators. • Discuss mitigation of power quality problems due to nonlinear loads. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Modern Tool Usage, Engineers and society, Ethics, Individual and Team work, Communication, Lifelong Learning.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Power Quality Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad	Wiley	2015

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II POWER ELECTRONIS LABORATORY-2			
Course Code	16EPEL26	IA Marks	20
Number of Practical Hours/Week	03	Exam Hours	03
Total Number of Practical Hours	40	Exam Marks	80
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to assess the performance of separately excited DC motor fed by single phase and three phase fully controlled converter in continuous and discontinuous current modes. • To conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • To simulate different converters and analyze the waveform in continuous and discontinuous current modes. • To simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Sl. NO	Experiments		
1	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
2	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
3	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
4	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
5	Performance analysis of a practical chopper fed DC Drives system for class-A and class-C commutation and analysis of wave forms in continuous mode.		
6	Simulation study of buck, boost and buck- boost converter (basic topologies) and analysis of wave forms for continuous current mode (CCM).		
7	Simulation study of buck, boost and buck-boost converter (basic topologies) and analysis of wave forms for discontinuous current mode (DCM).		
8	Simulation study of forward converter and fly back converter and performance analysis of various wave forms.		
9	Resonant converter simulation study and analysis.		
10	Closed loop operation of a buck and boost converter.		
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ – Understanding L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Conduct experiments on single phase / three phase fully controlled converter fed separately excited DC motor to assess the performance in continuous and discontinuous current modes. • Conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • Simulate different converters for analyzing the waveform in continuous and discontinuous current modes. • Simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - II			
SEMINAR			
Course Code	16EPE27	IA Marks	100
No. of Lecture Hours/Week	--	Exam Hours	--
Number of contact Hours/week	03	Number of Tutorial Hours/week	--
Total No. of contact Hours	--	Exam Marks	--
Credits - 01			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.</p> <p>Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The Internal Assessment marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairman. ■</p>			
<p>Marks distribution for internal assessment of the course 16EPE27 seminar:</p> <p>Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks</p>			
<p>Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

III SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE31	Seminar / Presentation on Internship. (After 8 weeks from the date of commencement)			--	25	--	25	20
2	16EPE32	Report on Internship	--	--	--	25	--	25	
3	16EPE33	Evaluation and Viva-Voce of Internship	--	--	--	--	50	50	
4	16EPE34	Evaluation of Project phase -1	--	--	--	50	--	50	1
TOTAL			--	--	--	100	50	150	21

Number of credits completed at the end of III semester: 22+ 22 + 21 = 65

Note:

Internship of 16 weeks shall be carried out during III semester.

Major part of the Project work shall also be carried out during the III semester in consultation with the Guide/s.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF TEACHING AND EXAMINATION - 2016-17
M.Tech POWER ELECTRONICS (EPE)
CHOICE BASED CREDIT SYSTEM (CBCS)
 (Total number of credits prescribed for the programme - 85)

IV SEMESTER

Sl. No	Course Code	Title	Teaching Hours /Week		Examination				Credits
			Theory	Practical/ Field work/ Assignment	Duration in hours	I.A. Marks	Theory/ Practical Marks	Total Marks	
1	16EPE41	HVDC power Transmission	04	--	03	20	80	100	4
2	16EPE42X	Elective - 3	03	--	03	20	80	100	3
3	16EPE43	Evaluation of Project phase - 2	--	--	--	50	-	50	3
4	16EPE44	Evaluation of Project and Viva-Voce	--	--	--	--	100 + 100	200	10
TOTAL			07	--	06	90	360	450	20

Number of credits completed at the end of IV semester: 22 + 22 + 21 + 20 = 85

Elective - 3

Course Code under 16EPE42X	Title
16EPE421	Digital Power Electronics
16EPE422	MPPT in Solar Systems
16EPE423	Multi-Terminal DC Grids
16EPE424	Multilevel Converters for Industrial Applications

Note: 1. Project Phase-1: 6-week duration shall be carried out between 2nd and 3rd Semester vacation. Candidates in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of Project.

2. Project Phase-2: 16-week duration during 4th semester. Evaluation shall be done by the committee comprising of HoD as Chairman, Guide and Senior faculty of the department.

3. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall be conducted

4. Project evaluation:

- a. Internal Examiner shall carry out the evaluation for 100 marks.
- b. External Examiner shall carry out the evaluation for 100 marks.
- c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
- d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

M.TECH POWER ELECTRONICS (EPE)			
CHOICE BASED CREDIT SYSTEM (CBCS)			
SEMESTER - IV			
HVDC POWER TRANSMISSION (Core Course)			
Course Code	16EPE41	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to DC power transmission and describe the basic components of a converter, and describe the methods for compensating the reactive power demanded by the converter and the methods for simulation of HVDC systems • To describe the types of filters for removing harmonics and the characteristics of the system impedance resulting from AC filter designs and different methods of control of HVDC converter and system. • To explain the design techniques for the main components of an HVDC system. • To explain the protection of HVDC system and other converter configurations used for the HVDC transmission and the recent trends for HVDC applications. ■ 			
Module-1			Teaching Hours
HVDC Technology: Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, Review of the HVDC System Reliability, HVDC Characteristics and Economic Aspects. Power Conversion: Thyristor, 3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Harmonics of HVDC and Removal: Introduction, Determination of Resulting Harmonic Impedance, Active Power Filter. Control of HVDC Converter and System: Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of HVDC Converter and System (continued): HVDC Control Functions, Reactive Power and Voltage Stability. Interactions between AC and DC Systems: Definition of Short Circuit Ratio and Effective Short Circuit Ratio, Interaction between HVDC and AC Power System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Main Circuit Design: Converter Circuit and Components, Converter Transformer, Cooling System, HVDC Overhead Line, HVDC Earth Electrodes, HVDC Cable, HVDC Telecommunications Current Sensors, HVDC Noise and Vibration. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Fault Behaviour and Protection of HVDC System: Valve Protection Functions, Protective Action of an HVDC System, Protection by Control Actions, Fault Analysis. Other Converter Configurations for HVDC Transmission: Introduction, Voltage Source Converter (VSC), CCC and CSCC HVDC System, 10.4 Multi-Terminal DC Transmission. Trends for HVDC Applications: Wind Farm Technology, Modern Voltage Source Converter (VSC) HVDC Systems, 800 kV HVDC System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE)
16EPE41 HVDC POWER TRANSMISSION (Core Course) (continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain importance of DC power transmission.
- Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter
- Explain the methods for simulation of HVDC systems and its control.
- Describe filters for eliminating harmonics and the characteristics of the system impedance resulting from AC filter designs
- Explain the design techniques for the main components of an HVDC system.
- Explain the protection of HVDC system and other converter configurations used for the HVDC transmission.
- Explain the recent trends for HVDC applications. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis, Lifelong Learning.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text/Reference Books

1	HVDC Transmission: Power Conversion Applications in Power Systems	Chan-Ki Kim et al	Wiley	2009
2	Direct Current Transmission	E.W. Kimbark	Wiley	1971
3	High Voltage Direct Current Transmission	Arrilaga	IET	2 nd Edition, 1998
4	HVDC Transmission	S. Kamakshaiiah et al	Mc Graw Hill	2011
5	HVDC and FACTS Controllers; Applications of Static Converters in Power Systems	Vijay K Sood	BSP Books	2013
6	HVDC Power Transmission Systems	K. R. Padiyar	New Age International	2012

M.TECH POWER ELECTRONICS (EPE) CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER - IV			
MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Elective Course)			
Course Code	16EPE424	IA Marks	20
Number of Lecture Hours/Week	03	Exam Hours	03
Total Number of Lecture Hours	40	Exam Marks	80
Credits - 03			
Course objectives:			
<ul style="list-style-type: none"> • To provide an overview of medium-voltage power converters and their applications. • To describe the generalized multilevel converter topology and to derive the classic converters with a common DC bus and to analyze the common characteristics of the symmetric topologies. • Explain the analysis of the operation of the diode-clamped multilevel converter, and a multilevel space vector modulation and to characterize the balancing boundary of the passive front-end converter • To describe the operation and analysis of the flying capacitor multilevel converter. • To explain asymmetric topology with hybrid modulation and a common DC source called a cascade asymmetric multilevel converter (CAMC) with five voltage levels and its advantages. • To analyse the behaviour of the CAMC as a distribution static compensator (DSTATCOM) and shunt active power filter in improving the power quality in medium-voltage distribution systems as custom power devices. • To analyse the behaviour of the diode-clamped topology configured as a back-to-back converter for several working conditions. ■ 			
Module-1			Teaching Hours
Converters: Introduction, Medium-Voltage Power Converters, Multilevel Converters, Applications. Multilevel Topologies: Introduction, Generalized Topology with a Common DC Bus, Converters Derived from the Generalized Topology, Symmetric Topologies without a Common DC Link, Summary of Symmetric Topologies, Asymmetric Topologies. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-2			
Diode-Clamped Multilevel Converter: Introduction, Converter Structure and Functional Description, Modulation of Multilevel Converters, Voltage Balance Control, Effectiveness Boundary of Voltage Balancing in DCMC Converters, Performance Results. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-3			
Flying Capacitor Multilevel Converter: Introduction, Flying Capacitor Topology, Modulation Scheme for the FCMC, Dynamic Voltage Balance of the FCMC. Cascade Asymmetric Multilevel Converter (CAMC): Introduction, General Characteristics of the CAMC, CAMC Three-Phase Inverter, Comparison of the Five-Level Topologies. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-4			
Case Study 1: DSTATCOM Built with a Cascade Asymmetric Multilevel Converter: Introduction, Compensation Principles, CAMC Model, Reactive Power and Harmonics Compensation. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-5			
Case Study 2: Medium-Voltage Motor Drive Built with DCMC: Introduction, Back-to-Back DCMC Converter, Unified Predictive Controller of the Back-to-Back DCMC in an IM Drive Application, Performance Evaluation. ■			08
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		

M.TECH POWER ELECTRONICS (EPE)
16EPE424 MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Elective Course)
(continued)
CHOICE BASED CREDIT SYSTEM (CBCS)

Course outcomes:

At the end of the course the student will be able to:

- Explain the working of medium-voltage power converters and their applications.
- Explain multilevel, symmetric and asymmetric topologies.
- Explain the structure and operation of the diode-clamped multilevel converter, and a multilevel space vector modulation.
- Characterize the balancing boundary of the passive front-end converter.
- Describe the operation and analysis of the flying capacitor multilevel converter.
- Discuss the characteristics topologies of the Cascade Asymmetric Multilevel Controller.
- Explain the working of a distribution static compensator (DSTATCOM) built with CAMC for reactive power and harmonic compensation.
- Evaluate the performance of back-to-back converter in an induction motor drive for several working conditions. ■

Graduate Attributes (As per NBA):

Engineering Knowledge, Problem Analysis.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Text Book

1	Multilevel Converters for Industrial Applications	Sergio Alberto González, Santiago Andrés Verne, María Inés Valla	CRC Press	2014
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VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus M.Tech POWER ELECTRONICS (EPE)

Eligibility: Bachelor's degree in Engineering or Technology in

- (a) Electrical and Electronics Engineering (b) Electronics and Communication Engineering
- (c) Electronics and Telecommunication Engineering (d) Telecommunication Engineering
- (e) Electronics and Instrumentation Engineering (f) Instrumentation Engineering
- (g) Biomedical Engineering (h) Medical Electronics (i) AMIE in appropriate branch
- (i) GATE: EC, IT, EE

(Effective from Academic year 2018-19)

**BOARD OF STUDIES IN ELECTRICAL AND ELECTRONICS ENGINEERING
July 2018**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018 - 19
M.Tech POWER ELECTRONICS (EPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	PCC	18EEE11	Mathematical Methods in Control	04	--	03	40	60	100	4
2	PCC	18EPE12	Power Semiconductor Devices and Components	04	--	03	40	60	100	4
3	PCC	18EPE13	Power Electronic Converters	04	--	03	40	60	100	4
4	PCC	18EPE14	Modelling and Design of Controllers	04	--	03	40	60	100	4
5	PCC	18EPE15	Modelling and Analysis of Electrical Machines	04	--	03	40	60	100	4
6	PCC	18EPE16	Power Electronics Laboratory - 1	-	04	03	40	60	100	2
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2
TOTAL				22	04	21	280	420	700	24

Note: PCC: Professional core.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018 - 19
M.Tech POWER ELECTRONICS (EPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	PCC	18EPE21	Electric Drives	04	--	03	40	60	100	4
2	PCC	18EPE22	Switched - Mode Power Supplies	04	--	03	40	60	100	4
3	PCC	18EPE23	Power System Harmonics	04	--	03	40	60	100	4
4	PEC	18EPE24X	Professional elective 1	04	--	03	40	60	100	4
5	PEC	18EPE25X	Professional elective 2	04	--	03	40	60	100	4
6	PCC	18EPEL26	Power Electronics Laboratory - 2	--	04	03	40	60	100	2
7	PCC	18EPE27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				20	06	18	340	360	700	24

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 1		Professional Elective 2	
Course Code under 18EPE24X	Course title	Course Code under 18EPE25X	Course title
18EPE241	Converters for Solar and Wind Power Systems	18EPE251	FACTS Controllers
18EPE242	Uninterruptible Power Supply	18EPE252	Digital Power Electronics
18EPE243	Hybrid Electric Vehicles	18EPE253	Embedded Systems

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairperson, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018 - 19
M.Tech POWER ELECTRONICS (EPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	PCC	18EPE31	HVDC power Transmission	04	--	03	40	60	100	4
2	PEC	18EPE32X	Professional elective 3	04	--	03	40	60	100	4
3	PEC	18EPE33X	Professional elective 4	04	--	03	40	60	100	4
4	Project	18EPE34	Project work phase -1	--	02	--	100	--	100	2
5	Internship	18EPEI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	260	240	500	20

Note: PCC: Professional core, PEC: Professional Elective.

Professional elective 3		Professional elective 4	
Course Code under 18EPE32X	Course title	Course Code under 18EPE33X	Course title
18EPE321	MPPT in Solar Systems	18EPE331	Advanced Control Systems
18EPE322	EMC in Power Electronics	18EPE332	Power Quality Problems and Mitigation
18EPE323	Multilevel Converters for Industrial Applications	18EPE333	Multi-Terminal DC Grids

Note:

1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairperson, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE (University examination) shall be as per the University norms.

2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements.

Internship SEE (University examination) shall be as per the University norms.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018 - 19
M.Tech POWER ELECTRONICS (EPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination			Credits	
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce		Total Marks
1	Project	18EPE41	Project work phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20

Note:

1. Project Phase-2:

CIE marks shall be awarded by a committee comprising of HoD as Chairperson, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

**I SEMESTER M.Tech
POWER ELECTRONICS**

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
MATHEMATICAL METHODS IN CONTROL			
(Professional Core Course)			
Course Code	18EEE11	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To introduce linear algebra in a best suitable approach for solving large number of equations using transformation methods. • To understand the techniques of numerical methods for estimating high accuracy in finding the roots and, in solving differential equations and their applications. ■ 			
Module-1			Teaching Hours
Introduction to vector spaces and sub-spaces, definitions, illustrative example. Linearly independent and dependent vectors- Basis-definition and problems. Linear transformations-definitions. Matrix form of linear transformations-Illustrative examples. ■			10
Revised Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding		
Module-2			
Solution of Systems of Linear Equations: Direct methods-Relaxation method, Partition method, Croute's Triangularisation method. Eigen values and Eigen vectors. Bounds on Eigen Values. Jacobi method & Givens method for symmetric matrices. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding , L ₃ – Applying		
Module-3			
Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. SVD and Applications. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding , L ₃ – Applying		
Module-4			
Probability: Random variables, Probability distributions: Binomial, Poisson, Normal distributions, Joint probability distribution (discrete and continuous)-Illustrative examples. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding		
Module-5			
Moments, central moments, characteristic functions, probability generating and moment generating functions-illustrations. Poisson, Gaussian and Erlang distributions-examples. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18EEE11 MATHEMATICAL METHODS IN CONTROL (Professional Core Course) (continued)				
Course outcomes: At the end of the course the student will be able to: <ol style="list-style-type: none"> 1. Understand the fundamentals of vector space and bases in reference to transformations. 2. Solve system of linear equations using direct and iterative methods. 3. Use the idea of Eigen values and Eigen vectors for the application of SVD. 4. Describe the basic notions of discrete and continuous probability distributions. 5. Find out responses of linear systems using statistical and probability tools. ■ 				
Graduate Attributes (As per NBA): Critical Thinking, Problem Solving, Research Skill, Usage of Modern Tools.				
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question consisting of 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 				
Textbooks				
1	Linear Algebra and its Applications	David C.Lay et al	Pearson	5th Edition,2015
2	Numerical Methods for Scientific and Engineering Computation	M. K. Jain et al	New Age International	9 th Edition, 2014
Reference Books				
3	Signals, Systems, and Inference	Alan V. Oppenheim and George C. Verghese	Pearson	2012
4	Numerical methods for Engineers	Steven C Chapra and Raymond P Canale	McGraw-Hill	7 th Edition, 2015
5	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44 th Edition, 2017
7	Web links: 1. http://nptel.ac.in/courses.php?disciplineId=111 2. http://www.class-central.com/Course/math(MOOCs) 3. http://ocw.mit.edu/courses/mathematics/			

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
POWER SEMICONDUCTOR DEVICES AND COMPONENTS			
(Professional Core Course)			
Course Code	18EPE12	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To enhance the knowledge of fundamentals of semiconductor physics, power electronics and power computation in circuits • To enhance the knowledge of fundamentals of various semiconductor devices, their operation and characteristics. • To explain the design and operation of drive circuits and snubber circuits. • To explain the controlling of temperature rise of the semiconductor devices and designing of magnetic components used for the power electronic circuits. ■ 			
Module-1			Teaching Hours
<p>Power Electronics: Introduction, Converter Classification, Power Electronics Concepts, Electronic Switches, Switch Selection, Spice, PSpice and Capture, Representation of switches in Pspice -The Voltage-Controlled Switch, Transistors, Diodes and Thyristors (SCRs).</p> <p>Power Computations: Introduction, Power and Energy, Inductors and Capacitors, Energy Recovery, Effective Values, Apparent Power and Power Factor, Power Computations for Sinusoidal AC Circuits, Power Computations for Nonsinusoidal Periodic Waveforms, Power Computations Using Pspice.</p> <p>Basic Semiconductor Physics: Introduction, Conduction Processes in Semiconductors pn Junctions, Charge Control Description of pn-Junction Operation, Avalanche Breakdown. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Power Diodes: Introduction, Basic Structure and I – V characteristics, Breakdown Voltage Considerations, On –State Losses, Switching Characteristics, Schottky Diodes.</p> <p>Bipolar Junction Transistors: Introduction, Vertical Power Transistor Structures, Z-V Characteristics, Physics of BJT Operation, Switching Characteristics, Breakdown Voltages, Second Breakdown, On-State Losses, Safe Operating areas.</p> <p>Power MOSFETs : Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Operating Limitations and Safe Operating Areas. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Thyristors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Switching Characteristics, Methods of Improving di/dt and dv/dt Ratings.</p> <p>Gate Turn-Off Thyristors: Introduction, Basic Structure and Z-V Characteristics, Physics of Turn-Off Operation, GTO Switching Characteristics, Overcurrent Protection of GTOs.</p> <p>Insulated Gate Bipolar Transistors: Introduction, Basic Structure, I-V Characteristics, Physics of Device Operation, Latchup in IGBTs, Switching Characteristics, Device Limits and SOAs.</p> <p>Emerging Devices and Circuits: Introduction, Power Junction Field Effect Transistors, Field-Controlled Thyristor, JFET-Based Devices versus Other Power Devices, MOS-Controlled Thyristors, Power Integrated Circuits, New Semiconductor Materials for Power Devices. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18EPE12 POWER SEMICONDUCTOR DEVICES AND COMPONENTS (Professional Core Course) (continued)				
Module-4				Teaching Hours
Snubber Circuits: Function and Types of Snubber Circuits, Diode Snubbers, Snubber Circuits for Thyristors, Need for Snubbers with Transistors, Turn-Off Snubber, Overvoltage Snubber, Turn-On Snubber, Snubbers for Bridge Circuit Configurations, GTO Snubber Considerations. Gate and Base Drive Circuits: Preliminary Design Considerations, dc-Coupled Drive Circuits, Electrically Isolated Drive Circuits, Cascode-Connected Drive Circuits, Thyristor Drive Circuits, Power Device Protection in Drive Circuits, Circuit Layout Considerations ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
Component Temperature Control and Heat Sinks: Control of Semiconductor Device Temperatures, Heat Transfer by Conduction, Heat sinks, Heat Transfer by Radiation and Convection. Design of Magnetic Components: Magnetic Materials and Cores, Copper Windings, Thermal Considerations, Analysis of a Specific Inductor Design, Inductor Design Procedures, Analysis of a Specific Transformer Design, Eddy Currents, Transformer Leakage Inductance, Transformer Design Procedure, Comparison of Transformer and Inductor Sizes. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Discuss power electronic concepts, electronic switches and semiconductor physics. • Explain representation of switches in P-spice and power computations. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; power diodes, power BJT, power MOSFET. • Explain the internal structure, the principle of operation, characteristics and base drive circuits of power semiconductor devices; thyristors, power IGBT, power FET. • Design Snubber circuits for the protection of power semiconductor devices. • Design gate and base drive circuits for power semiconductor devices • Design a heat sink to control the temperature rise of semiconductor devices • Design magnetic components inductors and transformers used in the power electronic circuits. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge Problem, Analysis, Design / development of solutions, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics	Daniel W Hart	McGraw Hill	
2	Power Electronics Converters, Applications, and Design	Ned Mohan et al	Wiley	3 rd Edition, 2014
3	Semiconductor Device Modeling with Spice	G. Massobrio, P. Antognetti	McGraw-Hill	2 nd Edition, 2010
4	Power Semiconductor Devices	B. Jayant Baliga	Springer	2008

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
POWER ELECTRONIC CONVERTERS (Professional Core Course)			
Course Code	18EPE13	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of PWM techniques in controlling the converter operation. • To impart knowledge of designing and analyzing DC – DC PWM converters and control modules. • To impart knowledge of designing and analyzing DC – AC and AC – DC converters. • To impart knowledge of analyzing different types of resonant converters and their control. • To impart knowledge of AC –AC converters and multilevel controllers. ■ 			
Module-1			Teaching Hours
PWM DC/DC Converters: Forward Converters - Analysis of the Basic Circuit, Galvanically Isolated Forward Converter, Boost Converter - Analysis of the Basic Scheme, Variation of the Output Voltage, Boundary Between the Continuous and the Discontinuous Mode , Discontinuous Mode Power Losses, Indirect Converter - Boundary Between the Continuous and the Discontinuous Mode, Discontinuous Mode, Indirect Converter with Galvanic Separation, Push – Pull (Symmetric) Converters - Analysis of Idealized Circuit in Continuous Mode, Output Characteristics, Selection of Components, DC Premagnetization of the Core, Half-Bridge Converter, Bridge Converter, Hamilton Circuit, Ćuk Converters - Elimination of the Current Ripple, Ćuk Converters with Galvanic Isolation. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Control Modules: Basic Principles and Characteristics of PWM Control Modules - Circuit Analysis, Simple PWM, Voltage-Controlled PWM, Current-Controlled PWM- Compensated PWM, IC Control Modules - Control Module TL494, Control Module SG1524/2524/3524, Control Module TDA 1060. DC/AC Converters – Inverters: Single-Phase Voltage Inverters - Pulse-Controlled Output Voltage, Pulse-Width Modulated Inverters - Unipolar PWM, Three-Phase Inverters-Overmodulation ($m_a > 1$), Asynchronous PWM, Space Vector Modulation - Space Vector Modulation: Basic Principles, Application of Space Vector Modulation Technique, Direct and Inverse Sequencing, Real Drive Influence. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
AC/DC Converters – Rectifiers: Half-Wave Single-Phase Rectifiers , Full-Wave Rectifiers - Commutation of Current, Output Filters - Capacitive Filter, L Filter, Voltage Doublers, Three-Phase Rectifiers, Phase Controlled Rectifiers - Full-Wave Thyristor Rectifiers, Three-Phase Thyristor Bridge Rectifiers, Twelve-Pulse Rectifiers, Rectifiers with Circuit for Power Factor Correction, Active Rectifier - Active Rectifier with Hysteresis Current Controller, PWM Rectifiers - Advanced Control Techniques of PWM Rectifiers , PWM Rectifier with Current Output, PWM Rectifiers in Active Filters, Some Topologies of PWM Rectifiers, Applications of PWM Rectifiers. ■			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18EPE13 POWER ELECTRONIC CONVERTERS (Professional Core Course) (continued)				
Module-4				Teaching Hours
Resonant Converters: Resonant Circuits - Resonant Converters of Class D, Series Resonant Converters, Parallel Resonant Converters, Series – Parallel Resonant Converter, Series Resonant Converters Based on GTO Thyristors, Class E Resonant Converters, DC/DC Converters Based on Resonant Switches - ZCS Quasi-resonant Converters, ZVS Quasi-resonant Converters, Multiresonant Converters, ZVS Resonant DC/AC Converters, Soft Switching PWM DC/DC Converters -Phase Shift Bridge Converters, Resonant Transitions PWM Converters, Control Circuits of Resonant Converters - Integrated Circuit Family UCx861-8, Integrated Circuits for Control of Soft, Switching PWM Converters. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Module-5				
AC/AC Converters: Single-Phase AC/AC Voltage Converters - Time Proportional Control Three-Phase Converters, Frequency Converters, Direct Frequency Converters, Introduction to AC/AC Matrix Converters - Basic Characteristics, Bidirectional Switches, Realization of Input Filter, Current Commutation, Protection of Matrix Converter, Application of Matrix Converter. Introduction to Multilevel Converters: Basic Characteristics -Multilevel DC/DC Converters, Time Interval: $nT < t < nT + DT$, $n = 0, 1, 2$, Time Interval: $nT + DT < t < (n + 1)T$, Multilevel Inverters - Cascaded H-Bridge Inverters, Diode-Clamped Multilevel Inverters, Flying Capacitor Multilevel Inverter, Other Multilevel Inverter Topologies, Control of Multilevel Inverters - Multilevel SPWM, Space Vector Modulation, Space Vector Control, Selective Harmonic Elimination. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Use the knowledge of PWM techniques in controlling different power electronic converters. • Apply the knowledge of power electronics in design and analysis of DC –DC PWM converters. • Design and analyze DC –AC and AC – DC converters and control their operation using PWM techniques. • Design and analyze different resonant converters and their control circuits. • Analyze AC – AC converters and multilevel converters. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters and Regulators	Branko L. Doki ć Branko Blanu š a	Springer (International Publishing, Switzerland)	3 rd Edition, 2015
2	Power Electronics Converters, Applications, and Design	Ned Mohan at el	Wiley	3 rd Edition, 2014

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I			
MODELLING AND DESIGN OF CONTROLLERS (Professional Core Course)			
Course Code	18EPE14	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge required for modeling and computer simulation of power electronic converters and systems. • To explain control system essentials in representing system in digital domain. • To explain the designing of digital controllers by different methods. • To explain the design and analysis of optimal and robust controllers by different methods. • To impart knowledge of discrete computation essentials. ■ 			
Module-1			Teaching Hours
Computer Simulation of Power Electronic Converters and Systems: Introduction, Challenges in Computer Simulation, Simulation Process, Mechanics of Simulation, Solution Techniques for Time-Domain Analysis, Widely Used, Circuit-Oriented Simulators, Equation Solvers. Modelling of Systems: Input-Output relations, Differential Equations and Linearization, State Space Representation, Transfer Function Representation, Block Diagrams, Lagrange method, Circuit Averaging, Bond Graphs, Space Vector Modelling. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.		
Module-2			
Control System Essentials: Representation of system in digital Domain, The Z – Transform, Digital Filter, Mapping between s – plane and z – plane, Effect of Sampling, Continuous to Discrete Domain Conversion, Control System Basics, Control Principles, State - Space Method. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Digital Controller Design: Controller Design Techniques, Bode Diagram Method, PID Controller, Root Locus Method, State Space Method, Full State Feedback, Regulator Design by Pole Placement, Estimation Design, Tracker : Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Digital Controller Design (continued): Controlling Voltage, Controlling Current, Control of Induction motor, Output Feedback, Induction motor Control with Output Feedback. Optimal and Robust Controller Design: Least Squares Principle, Quadratic Forms, Minimum Energy Principle, Least Square Solution, Weighted Least Squares, Recursive Least Squares, Optimal Control: Linear Quadratic, Induction motor example, Robust Controller Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18EPE14 MODELLING AND DESIGN OF CONTROLLERS (Professional Core Course) (continued)				
Module-5				Teaching Hours
Discrete Computation Essentials: Numeric Formats, Tracking the Base Point in the Fixed Point System, Normalization And Scaling, Arithmetic Algorithms. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Describe the role of computer simulations in the analysis and design of power electronics systems. • Understand the functional modeling of static systems. • Use sampling technique to determine a digital equivalent to a continuous time system. • Understand the control basics of digital systems. • Design digital controllers in discrete time and frequency domain. • Design optimal and robust controllers by different methods. • Explain essentials of discrete computation. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power Electronics Converters, Applications, and Design	Ned Mohan, Tore M. Undeland, William P. Robbins	Wiley	3 rd Edition,2014
2	Power Electronics Essentials and Applications	L.Umanand	Wiley	1 st Edition,2014

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Core Course)			
Subject Code	18EPE15	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To provide basic concepts of modelling of dc and ac machines. • To provide knowledge of theory of transformation of three phase variable to two phase variable. • To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modelling. • To provide modeling concepts of single phase and three phase transformers. • To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modelling. ■ 			
Module-1			Teaching Hours
<p>Basic Concepts of Modelling: Basic two pole machine representation of commutator machines, 3-phase synchronous machine with and without damper bar and 3-phase induction machine, Kron's primitive machine-voltage, current and torque equations.</p> <p>DC Machine Modelling: Mathematical model of separately excited DC motor-steady state and transient state analysis, sudden application of inertia load, transfer function of separately excited DC motor, mathematical model of dc series motor, shunt motor, linearization techniques for small perturbations. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
<p>Reference Frame Theory: Real time model of a two phase induction machine, transformation to obtain constant matrices, three phase to two phase transformation, power equivalence.</p> <p>Dynamic Modelling of Three Phase Induction Machine: Generalized model in arbitrary frame, electromagnetic torque, deviation of commonly used induction motor models-stator reference frames model, rotor reference frames model, synchronously rotating reference frames model, equations in flux linkages, per unit model, dynamic simulation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
<p>Small Signal Equations of the Induction Machine: Derivation of small signal equations of induction machine, space phasor model, DQ flux linkages model derivation, control principle of the induction motor.</p> <p>Transformer Modelling: Introduction, single phase transformer model, three phase transformer connections, per phase analysis, normal systems, per unit normalization, per unit three phase quantities, change of base, per unit analysis of normal system, regulating transformers for voltage and phase angle control, auto transformers, transmission line and transformers. ■</p>			10
Revised Bloom's Taxonomy Level	L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Module-4			
<p>Modelling of Synchronous Machines: Introduction, voltage equations and torque equation in machine variables, stator voltage equations in arbitrary and rotor reference frame variables, Park's equations, torque equations in substitute variables, rotor angle and angle between rotors, per unit system, analysis of steady state operation. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18EPE15 MODELLING AND ANALYSIS OF ELECTRICAL MACHINES (Professional Core Course) (continued)				
Module-5				Teaching Hours
Dynamic Analysis of Synchronous Machines: Dynamic performance during sudden change in input torque and during a 3-phase fault at the machine terminals, approximate transient torque versus rotor angle characteristics, comparison of actual and approximate transient torque-angle characteristics during a sudden change in input torque; first swing transient stability limit, comparison of actual and approximate transient torque-angle characteristics during a 3-phase fault at the machine terminals, critical clearing time, equal area criterion, computer simulation. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the basic concepts of modeling. • Develop mathematical models for DC motors for transient state analysis. • Use reference frame theory to transform three phase to two phase. • Develop dynamic model for three phase induction motor in stator and rotor reference frames. • Develop mathematical model of single phase transformers. • Model synchronous machine using Park's transformation for the analysis of steady state operation. • Model synchronous machine to perform dynamic analysis under different conditions. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Ethics,				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Generalized Theory of Electrical Machines	P.S.Bimbra	Khanna Publications	5th Edition, 1995
2	Electric Motor Drives - Modelling, Analysis & Control	R. Krishnan	PHI Learning Private Ltd	Indian Edition, 2009
3	Analysis of Electrical Machinery and Drive Systems	P.C.Krause, et al	Wiley	2nd Edition, 2010
4	Power System Analysis	Arthur R Bergen and Vijay Vittal	Pearson	2 nd Edition, 2009
5	Power System Stability and Control	Prabha Kundur	Mc Graw Hill	1 st Edition, 1994
6	Dynamic Simulation of Electric Machinery using Matlab / Simulink	Chee-Mun Ong	Prentice Hall	1998

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
POWER ELECTRONIS LABORATORY-1			
(Professional Core Course)			
Course Code	18EPEL16	CIE Marks	40
Number of Practical Hours/Week	04	Exam Hours	03
Total Number of Practical Hours	56	SEE Marks	60
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiment on various power electronic devices to analyze their static and dynamic characteristics. • To conduct experiments and enhance understanding of different power electronic converters. ■ 			
Sl. NO	Experiments		
1	Analysis of static and dynamic characteristic of MOSFET and IGBT.		
2	Performance of single phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
3	Performance of single phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
4	Study of effect of source inductance on the performance of single phase fully controlled converter.		
5	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for continuous current mode.		
6	Performance analysis of three phase fully controlled and semi-controlled converter for RL load for discontinuous current mode.		
7	Performance analysis of single phase bridge inverter for RL load and voltage control by single pulse width modulation.		
8	Performance analysis of two quadrant chopper.		
9	Diode clamped multilevel inverter.		
10	ZVS operation of a Synchronous buck converter.		
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Analyze the static and dynamic characteristics of various semiconductor devices. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for continuous current modes. • Apply the knowledge of converters in assessing the performance of single phase and three phase fully controlled and semi controlled converters for RL load for discontinuous current modes. • Assess the performance of single phase bridge inverter for RL load and control the voltage by pulse width modulation. • Apply the knowledge of power electronics in performance analysis of chopper and synchronous buck converter. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - I			
RESEARCH METHODOLOGY AND IPR			
(Professional Core Course) and (Common to all M.Tech Programmes)			
Course Code	18RMI17	CIE Marks	40
Number of Lecture Hours/Week	02	Exam Hours	03
Total Number of Lecture Hours	25	SEE Marks	60
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview of the research methodology and explain the technique of defining a research problem • To explain the functions of the literature review in research. • To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review. • To explain various research designs and their characteristics. • To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections. • To explain several parametric tests of hypotheses and Chi-square test. • To explain the art of interpretation and the art of writing research reports. • To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment. • To discuss leading International Instruments concerning Intellectual Property Rights. ■ 			
Module-1			Teaching Hours
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. ■			05
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. ■			05
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. ■			05
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE)		
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)		
SEMESTER - I		
18RMI17 RESEARCH METHODOLOGY AND IPR		
(Professional Core Course) and (Common to all M.Tech Programmes)		
Module-4		Teaching Hours
<p>Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.</p> <p>Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. ■</p>		05
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	
Module-5		
<p>Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.</p> <p>Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ■</p>		05
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.	
Course outcomes:		
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Discuss research methodology and the technique of defining a research problem • Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review. • Explain various research designs and their characteristics. • Explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections • Explain several parametric tests of hypotheses and Chi-square test. • Explain the art of interpretation and the art of writing research reports • Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■ 		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - I				
18RMI17RESEARCH METHODOLOGY AND IPR (Professional Core Course) and (Common to all M.Tech Programmes)				
Graduate Attributes (As per NBA): Problem analysis, Investigation, Design, Individual and teamwork, Communication skills, Professionalism.				
Question paper pattern:				
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Textbooks				
1	Research Methodology: Methods and Techniques	C.R. Kothari, Gaurav Garg	New Age International	4 th Edition, 2018
2	Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2)	Ranjit Kumar	SAGE Publications Ltd	3 rd Edition, 2011
3	Study Material (For the topic Intellectual Property under module 5)	Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013		
Reference Books				
1	An introduction to Research Methodology	Garg B.L et al	RBSA Publishers	2002
2	An Introduction to Multivariate Statistical Analysis	Anderson T.W	Wiley	3 rd Edition, 2003
3	Research Methodology	Sinha, S.C, Dhiman	Ess Ess Publications	2002
4	Research Methods: the concise knowledge base	Trochim	Atomic Dog Publishing	2005
5	How to Write and Publish a Scientific Paper	Day R.A	Cambridge University Press	1992
6	Conducting Research Literature Reviews: From the Internet to Paper	Fink A	Sage Publications	2009
7	Proposal Writing	Coley S.M. Scheinberg, C.A	Sage Publications	1990
8	Intellectual Property Rights in the Global Economy	Keith Eugene Maskus	Institute for International Economics	2000

*** END ***

**II SEMESTER M.Tech
POWER ELECTRONICS**

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
ELECTRIC DRIVES (Professional Core Course)			
Course Code	18EPE21	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to drive, their characteristics and breaking. • To explain the basic elements of drives, classification of drives, their dynamics and speed control • To explain selection of drive for a specific application. • To explain control of an electric drive using microprocessor. ■ 			
Module-1			Teaching Hours
Characteristics Electric motors: Introduction, Characteristics of DC motors, Three phase Induction Motors and Synchronous Motors, Braking of Electric Motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Dynamics of Electric Drives: Introduction, Classification of Electric Drives, Basic Elements of an Electric Drive, Dynamic Conditions of Drive System, Stability Considerations of Electric Drive. Control of Electric Motors: Induction Motor Drives. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of Electric Motors (continued): Synchronous Motor Drives, DC Drives. Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Control of Electric Motors (continued): Permanent Magnet Synchronous Motor, Classification of Permanent Magnet Synchronous Motor, Cycloconverters fed Synchronous Motor. Applications: Drive Considerations for Textile Mills, Steel Rolling Mills, Cranes and Hoist Drives, Cement Mills, Sugar Mills, Machine Tools, Paper Mills, Coal Mines, Centrifugal Pumps, Turbo - compressors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Microprocessors and Control of Electrical Drives: Introduction, Dedicated Hardware Systems versus Microprocessor Control, Applications Area and Functions of Microprocessors in Drive Technology, Control of Electric Drives using Microprocessors, Control System Design of Microprocessors based Variable Speed Drives, Stepper motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - II				
18EPE21 ELECTRIC DRIVES (Professional Core Course) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain characteristics of DC motors, induction motors and synchronous motors. • Explain braking of electric motors. • Classify electric drives. • Discuss dynamics conditions and stability considerations of Electric drive. • Control the speed of electric motors. • Suggest a drive for a specific application. • Explain using microprocessor in the control of an electric drive. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Electric Drives Concepts and Applications	Vedam Subrahmanyam	Mc Graw Hill	2 nd Edition, 2016

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
SWITCHED - MODE POWER SUPPLIES (Professional Core Course)			
Course Code	18EPE22	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an overview on SMPS, its characteristics, new technologies, basic principles and control modes. • To introduce the topology of DC/DC converter used and the method of selecting key peripheral components of SMPS. • To explain the power factor correction circuit design of SMPS, the design of high-frequency transformer, the examples of SMPS optimization design, and the key design points of SMPS. • To introduce the SMPS testing technology and the protection circuit design of SMPS. ■ 			
Module-1			Teaching Hours
<p>Switching-Mode Power Supply (SMPS): Overview, Classification of Integrated Regulated Power Supply, Characteristics of SMPS, New Development Trend of SMPS, Basic Principles of SMPS, Control Mode Type of SMPS, Working Mode of SMPS, Feedback Type of SMPS, Load Characteristics of SMPS.</p> <p>Topologies of the DC/DC Converter: Topologies of the DC/DC Converter, Basic Principle of Buck Converter, Basic Principle of - Boost Converter, Buck-Boost Converter, Charge Pump Converter, (Single-ended primary inductor converter)SEPIC, Flyback Converter, Forward Converter, Push-Pull Converter, Half/Full Bridge Converter, Soft Switching Converter, Half-Bridge LLC Resonant Converter, 2-Switch Forward Converter. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
<p>Method for Selecting Key Peripheral Components of SMPS: Selection Method for - Fixed Resistor, Capacitors, Inductor Characteristics and Selection Method for Magnetic Beads, Selection Method for EMI Filter - Input Bridge Rectifier, Output Rectifier, Transient Voltage Suppressor (TVS), Power Switching Tube, Optical Coupler, Adjustable Precision Shunt Regulator, SMPS Protection Elements. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
<p>Power Factor Correction Circuit Design of SMPS: Brief Introduction to Power Factor Correction (PFC), Basic Principle of Passive PFC Circuit, Design Examples of Passive PFC Circuit, Basic Principle of Active PFC Circuit, Design Examples of Active PFC Circuit, Principle and Application of High-Power PFC, Measures to Suppress PFC Electromagnetic Interference, PFC Configuration Scheme.</p> <p>Design of High-Frequency Transformer: Selection Method for Magnetic Cores by the Empirical Formula or Output Power Table, Waveform Parameters of the High-Frequency Transformer Circuit, Formula Derivation of Selecting High-Frequency Transformer Magnetic Core Based on AP Method, Design of Flyback High-Frequency Transformer, Design of Forward High-Frequency Transformer, Loss of High-Frequency Transformer. ■</p>			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ – Applying.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - II				
18EPE22 SWITCHED - MODE POWER SUPPLIES (Professional Core Course) (continued)				
Module-4				Teaching Hours
Key Design Points of SMPS: SMPS Design Requirements, Design of High-Efficiency SMPS, Methods of Reducing No-Load and Standby Power Consumption of SMPS, Stability Design of Optocoupler Feedback Control Loop SMPS Layout and Wiring, Design of Constant Voltage/Current SMPS, Design of Precision Constant Voltage/Current SMPS, Design of Remote Turn-Off Circuit for SMPS, Typical Application and Printed Circuit Design of New Single-Chip SMPS, Electromagnetic Interference Waveform Analysis and Safety Code Design of SMPS, Radiator Design of Single-Chip SMPS, Radiator Design of Power Switching Tube (MOSFET), Common Troubleshooting Methods of SMPS. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying.			
Module-5				
SMPS Testing Technology: Parameter Testing of SMPS, Performance Testing of SMPS, SMPS Measurement Skills, Accurate Measurement Method of Duty Ratio, Method to Detect the Magnetic Saturation of High-Frequency Transformer with Oscilloscope, Digital Online Current/Resistance Meter, Electromagnetic Compatibility Measurement of SMPS, Waveform Test and Analysis of SMPS. Protection and Monitoring Circuit Design of SMPS: Design of Drain Clamp Protection Circuit, Overvoltage Protection Circuit Constituted by Discrete Components, Application of Integrated Overvoltage Protector, Design of Undervoltage Protection Circuit, Design of Overcurrent and Overpower Protection Circuit, Design of Soft-Start Circuit, Mains Voltage Monitor, Transient Interference and Audio Noise Suppression Technology of SMPS, Design of Overheating Protection Component and Cooling Control System. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain a SMPS, its characteristics, new technologies, basic principles and control modes. • Suggest a suitable DC/DC converter for an SMPS. • Explain the method of selecting key peripheral components of SMPS. • Design the power factor correction circuit of SMPS. • Explain selection of magnetic core and designing of high-frequency transformer. • Explain designing of different SMPS. • Explain testing technology of SMPS. • Design protection and monitoring circuit for SMPS. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Ethics, Communication.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Optimal Design of Switching Power Supply	Zhanyou Sha et al	Wiley	2015

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
POWER SYSTEM HARMONICS (Professional Core Course)			
Course Code	18EPE23	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain about different sources of harmonics in power system. • To explain effects of harmonics and mitigation of harmonics. • To explain modeling of power system components for harmonic studies. • Introducing different methods of harmonic studies. ■ 			
Module-1			Teaching Hours
Fundamentals of Harmonics: Introduction, Examples of harmonic waveforms, characteristics of harmonics in power systems, measurement of harmonic distortion, power in passive elements, calculation of passive elements, resonance, capacitor banks and reactive power supply, capacitor banks and power factor correction, bus voltage rise and resonance, harmonics in transformers. Harmonics in Power system: Introduction, sources of harmonics, transformers, rotating machines, fluorescent lights, static var compensators, cycloconverters. Single phase controlled rectifiers, three phase converters. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Effects of Harmonic Distortion on Power System: Introduction, thermal losses in a harmonic environment, harmonic effects on power system equipment, capacitor banks, transformers, rotating machines, protection, communication and electronic equipment. Mitigation of Power system Harmonics: Introduction, harmonic filters, power converters, transformers, rotating machines, capacitor banks, harmonic filter design, active filters. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Limits of Harmonic Distortion: Introduction, voltage harmonic distortion limits, current harmonic distortion limits. Harmonic studies – Modelling of System Components: Introduction, impedance in the presence of harmonics, skin effect, modelling of the high voltage grid, generator modelling, modelling of shunt capacitor banks, series capacitor banks, load models, induction motor modelling. Transformer Modelling: Introduction, modelling of two winding transformers, phase sequence admittance matrices, transmission of voltage and current across two winding transformers, transmission matrices and phase admittance matrix, modelling of three and four winding transformers. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Modelling of Transmission lines/Cables: Introduction, skin effect, modelling of power lines, Line's series impedance, mutual coupling between conductors, mutually coupled lines, line's shunt capacitance, surge impedance and velocity of propagation, line's series impedance and shunt capacitance – single phase equivalents, the transmission (ABCD) matrix, the admittance matrix, conversion between the transmission and admittance matrices, the nominal pi model – single phase equivalent, the equivalent pi model – voltage and current the line, line losses, the equivalent pi model – single phase equivalent, variations in the network's short circuit capacity, examples – the nominal and equivalent models. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - II				
18EPE23 POWER SYSTEM HARMONICS (Professional Core Course) (continued)				
Module-5				Teaching Hours
Power System Harmonic Studies: Introduction, harmonic analysis using a computer program, harmonic analysis using spread sheet, harmonic distortion limits, harmonic filter rating, and practical considerations. Harmonic study of simple system, 300 -22 kV power system and low voltage system. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the fundamentals that facilitate the understanding of the issues of harmonics. • Explain the causes for generation of harmonics. • Explain the effects of harmonics distortion on power system equipment and loads and suppression of harmonics in power systems. • Discuss standard limits of harmonic distortion and modeling of power system components for harmonic analysis study. • Model transmission lines and cables for harmonic analysis. • Discuss implementation of harmonic studies. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Modern Tool Usage, Ethics.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	Power System Harmonics	George J Wakileh	Springer	Reprint, 2014
2	Power System Harmonic Analysis	Jos Arrillaga et al	Wiley	Reprint, 2014
3	Power System Harmonic	J. Arrillaga, N.R. Watson	Wiley	2 nd Edition, 2003
4	Harmonics and Power Systems	Francisco C. DE LA Rosa	CRC Press	1 st Edition, 2006

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
HYBRID ELECTRIC VEHICLES (Professional Elective Course)			
Course Code	18EPE243	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals. • To explain plug – in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles. • To discuss various electric drives suitable for hybrid electric vehicles • To discuss different energy storage technologies used for hybrid electric vehicles and their control. • To explain modeling and simulation of electric hybrid vehicles by different techniques, sizing of components and design optimization and energy management. ■ 			
Module-1			Teaching Hours
Introduction: Sustainable Transportation, A Brief History of HEVs, Why EVs Emerged and Failed, Architectures of HEVs, Interdisciplinary Nature of HEVs, State of the Art of HEVs, Challenges and Key Technology of HEVs. Hybridization of the Automobile: Vehicle Basics, Basics of the EV, Basics of the HEV, Basics of Plug-In Hybrid Electric Vehicle (PHEV), Basics of Fuel Cell Vehicles (FCVs). HEV Fundamentals: Introduction, Vehicle Model, Vehicle Performance, EV Powertrain Component Sizing, Series Hybrid Vehicle, Parallel Hybrid Vehicle, Wheel Slip Dynamics. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Plug-in Hybrid Electric Vehicles: Introduction to PHEVs, PHEV Architectures, Equivalent Electric Range of Blended PHEVs, Fuel Economy of PHEVs, Power Management of PHEVs, PHEV Design and Component Sizing, Component Sizing of EREVs, Component Sizing of Blended PHEVs, HEV to PHEV Conversions, Other Topics on PHEVs, Vehicle-to-Grid Technology. Power Electronics in HEVs: Introduction, Principle of Power Electronics, Rectifiers Used in HEVs, Buck Converter Used in HEVs, Non-isolated Bidirectional DC–DC Converter, Voltage Source Inverter, Current Source Inverter, Isolated Bidirectional DC–DC Converter, PWM Rectifier in HEVs, EV and PHEV Battery Chargers, Modelling and Simulation of HEV Power Electronics, Emerging Power Electronics Devices, Circuit Packaging, Thermal Management of HEV Power Electronics. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Electric Machines and Drives in HEVs: Introduction, Induction Motor Drives, Permanent Magnet Motor Drives, Switched Reluctance Motors, Doubly Salient Permanent Magnet Machines, Design and Sizing of Traction Motors, Thermal Analysis and Modelling of Traction Motors. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Batteries, Ultracapacitors, Fuel Cells, and Controls: Introduction, Battery Characterization, Comparison of Different Energy Storage Technologies for HEVs, Modelling Based on Equivalent Electric Circuits, Battery Charging Control, Charge Management of Storage Devices, Flywheel Energy Storage System, Hydraulic Energy Storage System, Fuel Cells and Hybrid Fuel Cell Energy Storage System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - II				
18EPE243 HYBRID ELECTRIC VEHICLES (Professional Elective Course) (continued)				
Module-5				Teaching Hours
Modelling and Simulation of Electric and Hybrid Vehicles: Introduction, Fundamentals of Vehicle System Modelling, HEV Modelling Using ADVISOR, HEV Modelling Using PSAT, Physics-Based Modelling, Bond Graph and Other Modelling Techniques, Consideration of Numerical Integration Methods, Conclusion. HEV Component Sizing and Design Optimization: Introduction, Global Optimization Algorithms for HEV Design, Model-in-the-Loop Design Optimization Process, Parallel HEV Design Optimization Example, Series HEV Design Optimization Example, Conclusion. Vehicular Power Control Strategy and Energy Management: A Generic Framework, Definition, and Needs, Methodology to Implement, Benefits of Energy Management. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals. • Explain plug – in hybrid electric vehicle architecture, design and component sizing. • Explain the use of different power electronics devices in hybrid electric vehicles. • Suggest a suitable electric drive for a specific type of hybrid electric vehicle. • Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control. • Simulate electric hybrid vehicles by different techniques for the performance analysis. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Modern Tool Usage, Individual and Team work, Communication.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Hybrid Electric Vehicles principles and Applications with Practical Perspectives	Chris Mi,M. Abul Masrur,David Wenzhong Gao	Wiley	2011

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
EMBEDDED SYSTEMS (Professional Elective Course)			
Course Code	18EPE253	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To impart knowledge of embedded systems with suitable examples, explanation of process, classification of embedded systems. • To explain the processor architecture, memory organization, communication with processor and interrupt services. • To explain the program modeling concepts, inter-process communication and synchronization of processes. ■ 			
Module-1			Teaching Hours
Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems – on –chip (Soc) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design of Process in Embedded System, Formulation of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skill required for an Embedded System Designer. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Processor Architecture and Memory Organisation: 8051 Architecture, Real world Interfacing, Introduction to Advanced Architecture, Processor and Memory Organization, Instruction Level Parallelism, Performance Metrics, Memory – Types, Memory – Maps and Addresses, Processor Selection, Memory Selection. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Devices and Communication Buses, Interrupt Services: IO Types and Examples, Serial Communication Devices, Parallel Device Ports, Sophisticated Interfacing Features in Device Ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Serial Bus Device Protocols – Parallel Communication Network Using ISA,PCI, PCI –X and Advanced Protocols. Device Drivers and Interrupts Service Mechanisms: Programmed – I/O Busy – wait Approach without Interrupt Service Mechanism, ISR Concept, Interrupt Sources, Interrupt Servicing Mechanism, Direct Memory Access. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Program Modelling concepts: Program Models, DFG Models, State Machine Programming Models for Event – controlled Program Flow, Modelling of Multiprocessor Systems, UML Modelling. Interprocess Communication and Synchronization of Processes, Threads and Tasks: Multiple Processes in an Application, Multiple Threads in an Application, Tasks, Task Status, Task and Data, Clear – cut Distention Between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Interprocess Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - II				
18EPE253 EMBEDDED SYSTEMS (Professional Elective Course) (Continued)				
Module-5				Teaching Hours
Real - Time Operating Systems: OS Services, Process Management, Timer Functions, Event Functions, Memory management, Device, File and IO Subsystems Management , Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real – time Operating Systems, Basic Design Using an RTOS, Rtos Task Scheduling Models, Interrupt Latency and Response of the task as performance Metrics, OS Security Issues. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain design process in embedded system and formulation of system design. • Describe processor architecture and memory organization. • Describe the devices; serial port, parallel port devices, timing devices, devices for synchronous iso-synchronous and asynchronous communication. • Describe device drivers and interrupt mechanisms. • Explain the programming concepts and source code engineering tools for embedded programming. • Explain real time programming and program modeling concepts during single and multi-processor system software development process. • Describe real time operating systems concepts. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Embedded Systems: Architecture, Programming and Design	Raj Kamal	Mc Graw Hill	2 nd Edition,2014

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
POWER ELECTRONIS LABORATORY-2			
Course Code	18EPEL26	CIE Marks	40
Number of Practical Hours/Week	04	Exam Hours	03
Total Number of Practical Hours	56	SEE Marks	60
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • To conduct experiments to assess the performance of separately excited DC motor fed by single phase and three phase fully controlled converter in continuous and discontinuous current modes. • To conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • To simulate different converters and analyze the waveform in continuous and discontinuous current modes. • To simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Sl. NO	Experiments		
1	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
2	Study and performance analysis of single phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
3	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for continuous current mode.		
4	Study and performance analysis of three phase fully controlled converter fed separately excited DC Motor for discontinuous current mode.		
5	Performance analysis of a practical chopper fed DC Drives system for class-A and class-C commutation and analysis of wave forms in continuous mode.		
6	Simulation study of buck, boost and buck- boost converter (basic topologies) and analysis of wave forms for continuous current mode (CCM).		
7	Simulation study of buck, boost and buck-boost converter (basic topologies) and analysis of wave forms for discontinuous current mode (DCM).		
8	Simulation study of forward converter and fly back converter and performance analysis of various wave forms.		
9	Resonant converter simulation study and analysis.		
10	Closed loop operation of a buck and boost converter.		
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ – Understanding L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Conduct experiments on single phase / three phase fully controlled converter fed separately excited DC motor to assess the performance in continuous and discontinuous current modes. • Conduct experiments to assess the performance of Chopper fed DC drives for class A and class C commutation in continuous current mode. • Simulate different converters for analyzing the waveform in continuous and discontinuous current modes. • Simulate forward converter, fly back converter and resonant converter to study their performance. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Conduct investigations of complex Problems, Modern Tool Usage, Individual and Team work, Communication.			

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - II			
TECHHNICAL SEMINAR			
Course Code	18EPE27	CIE Marks	100
Number of contact Hours/week	02	Exam Hours	--
Total No. of contact Hours	--	SEE Marks	--
Credits - 02			
Course objectives:			
<p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.</p> <p>Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with</p>			
Marks distribution for CIE of the course 18EPE27 seminar:			
Seminar Report: 30 marks			
Presentation skill:50 marks			
Question and Answer:20 marks			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			

*** END ***

**III SEMESRER M.Tech
POWER ELECTRONICS**

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - III			
HVDC POWER TRANSMISSION (Professional Core Course)			
Course Code	18EPE31	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To give an introduction to DC power transmission and describe the basic components of a converter, and describe the methods for compensating the reactive power demanded by the converter and the methods for simulation of HVDC systems • To describe the types of filters for removing harmonics and the characteristics of the system impedance resulting from AC filter designs and different methods of control of HVDC converter and system. • To explain the design techniques for the main components of an HVDC system. • To explain the protection of HVDC system and other converter configurations used for the HVDC transmission and the recent trends for HVDC applications. ■ 			
Module-1			Teaching Hours
HVDC Technology: Introduction, Advantages of HVDC Systems, HVDC System Costs, Overview and Organization of HVDC Systems, Review of the HVDC System Reliability, HVDC Characteristics and Economic Aspects. Power Conversion: Thyristor, 3-Phase Converter, 3-Phase Full Bridge Converter, 12-Pulse Converter. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-2			
Harmonics of HVDC and Removal: Introduction, Determination of Resulting Harmonic Impedance, Active Power Filter. Control of HVDC Converter and System: Converter Control for an HVDC System, Commutation Failure, HVDC Control and Design. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-3			
Control of HVDC Converter and System (continued): HVDC Control Functions, Reactive Power and Voltage Stability. Interactions between AC and DC Systems: Definition of Short Circuit Ratio and Effective Short Circuit Ratio, Interaction between HVDC and AC Power System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-4			
Main Circuit Design: Converter Circuit and Components, Converter Transformer, Cooling System, HVDC Overhead Line, HVDC Earth Electrodes, HVDC Cable, HVDC Telecommunications Current Sensors, HVDC Noise and Vibration. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		
Module-5			
Fault Behaviour and Protection of HVDC System: Valve Protection Functions, Protective Action of an HVDC System, Protection by Control Actions, Fault Analysis. Other Converter Configurations for HVDC Transmission: Introduction, Voltage Source Converter (VSC), CCC and CSCC HVDC System, 10.4 Multi-Terminal DC Transmission. Trends for HVDC Applications: Wind Farm Technology, Modern Voltage Source Converter (VSC) HVDC Systems, 800 kV HVDC System. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - III				
18EPE31 HVDC POWER TRANSMISSION (Professional Core Course) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain importance of DC power transmission. • Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter • Explain the methods for simulation of HVDC systems and its control. • Describe filters for eliminating harmonics and the characteristics of the system impedance resulting from AC filter designs • Explain the design techniques for the main components of an HVDC system. • Explain the protection of HVDC system and other converter configurations used for the HVDC transmission. • Explain the recent trends for HVDC applications. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Lifelong Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text/Reference Books				
1	HVDC Transmission: Power Conversion Applications in Power Systems	Chan-Ki Kim et al	Wiley	2009
2	Direct Current Transmission	E.W. Kimbark	Wiley	1971
3	High Voltage Direct Current Transmission	Arrilaga	IET	2 nd Edition, 1998
4	HVDC Transmission	S. Kamakshaiiah et al	Mc Graw Hill	2011
5	HVDC and FACTS Controllers; Applications of Static Converters in Power Systems	Vijay K Sood	BSP Books	2013
6	HVDC Power Transmission Systems	K. R. Padiyar	New Age International	2012

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - III			
MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Professional Elective Course)			
Course Code	18EPE323	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives:			
<ul style="list-style-type: none"> • To provide an overview of medium-voltage power converters and their applications. • To describe the generalized multilevel converter topology and to derive the classic converters with a common DC bus and to analyze the common characteristics of the symmetric topologies. • Explain the analysis of the operation of the diode-clamped multilevel converter, and a multilevel space vector modulation and to characterize the balancing boundary of the passive front-end converter • To describe the operation and analysis of the flying capacitor multilevel converter. • To explain asymmetric topology with hybrid modulation and a common DC source called a cascade asymmetric multilevel converter (CAMC) with five voltage levels and its advantages. • To analyse the behaviour of the CAMC as a distribution static compensator (DSTATCOM) and shunt active power filter in improving the power quality in medium-voltage distribution systems as custom power devices. • To analyse the behaviour of the diode-clamped topology configured as a back-to-back converter for several working conditions. ■ 			
Module-1			Teaching Hours
Converters: Introduction, Medium-Voltage Power Converters, Multilevel Converters, Applications. Multilevel Topologies: Introduction, Generalized Topology with a Common DC Bus, Converters Derived from the Generalized Topology, Symmetric Topologies without a Common DC Link, Summary of Symmetric Topologies, Asymmetric Topologies. ■			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-2			
Diode-Clamped Multilevel Converter: Introduction, Converter Structure and Functional Description, Modulation of Multilevel Converters, Voltage Balance Control, Effectiveness Boundary of Voltage Balancing in DCMC Converters, Performance Results. ■			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-3			
Flying Capacitor Multilevel Converter: Introduction, Flying Capacitor Topology, Modulation Scheme for the FCMC, Dynamic Voltage Balance of the FCMC. Cascade Asymmetric Multilevel Converter (CAMC): Introduction, General Characteristics of the CAMC, CAMC Three-Phase Inverter, Comparison of the Five-Level Topologies. ■			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-4			
Case Study 1: DSTATCOM Built with a Cascade Asymmetric Multilevel Converter: Introduction, Compensation Principles, CAMC Model, Reactive Power and Harmonics Compensation. ■			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		
Module-5			
Case Study 2: Medium-Voltage Motor Drive Built with DCMC: Introduction, Back-to-Back DCMC Converter, Unified Predictive Controller of the Back-to-Back DCMC in an IM Drive Application, Performance Evaluation. ■			10
Revised Bloom's Taxonomy Level	L ₁ - Remembering, L ₂ - Understanding, L ₃ - Applying, L ₄ - Analyzing, L ₅ - Evaluating, L ₆ - Creating		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - III				
18EPE323 MULTILEVEL CONVERTERS FOR INDUSTRIAL APPLICATIONS (Professional Elective Course) (continued)				
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the working of medium-voltage power converters and their applications. • Explain multilevel, symmetric and asymmetric topologies. • Explain the structure and operation of the diode-clamped multilevel converter, and a multilevel space vector modulation. • Characterize the balancing boundary of the passive front-end converter. • Describe the operation and analysis of the flying capacitor multilevel converter. • Discuss the characteristics topologies of the Cascade Asymmetric Multilevel Controller. • Explain the working of a distribution static compensator (DSTATCOM) built with CAMC for reactive power and harmonic compensation. • Evaluate the performance of back-to-back converter in an induction motor drive for several working conditions. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Multilevel Converters for Industrial Applications	Sergio Alberto González, Santiago Andrés Verne, María Inés Valla	CRC Press	2014

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - III			
POWER QUALITY PROBLEMS AND MITIGATION (Professional Elective Course)			
Course Code	18EPE332	CIE Marks	40
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	SEE Marks	60
Credits - 04			
Course objectives: <ul style="list-style-type: none"> To give an introduction on power quality (PQ), causes and effects of PQ problems, requirement of PQ improvements, and mitigation aspects of PQ problems. To give PQ definitions, terminologies, standards, benchmarks, monitoring requirements through numerical problems. To explain passive shunt and series compensation using lossless passive LC components, active shunt compensation using DSTATCOM (distribution static compensators), active series compensation using DVR (dynamic voltage restorer), and combined compensation using UPQC (unified power quality compensator) for mitigation of current-based PQ problems. To explain classification, modeling and analysis of various nonlinear loads which cause the power quality problems. ■ 			
Module-1			Teaching Hours
Power Quality: Introduction, State of the Art on Power Quality, Classification of Power Quality Problems, Causes of Power Quality Problems, Effects of Power Quality Problems on Users, Classification of Mitigation Techniques for Power Quality Problems. Power Quality Standards and Monitoring: Introduction, State of the Art on Power Quality Standards and Monitoring, Power Quality Terminologies, Power Quality Definitions, Power Quality Standards, Power Quality Monitoring, Numerical Examples. Passive Shunt and Series Compensation: Introduction, State of the Art on Passive Shunt and Series Compensators, Classification of Passive Shunt and Series Compensators, Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators, Modelling, Simulation, and Performance of Passive Shunt and Series Compensators, Numerical Examples. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-2			
Active Shunt Compensation: Introduction, State of the Art on DSTATCOMs, Classification of DSTATCOMs, Principle of Operation and Control of DSTATCOMs, Analysis and Design of DSTATCOMs, Modelling, Simulation, and Performance of DSTATCOMs, Numerical Examples. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-3			
Active Series Compensation: Introduction, State of the Art on Active Series Compensators, Classification of Active Series Compensators, Principle of Operation and Control of Active Series Compensators, Analysis and Design of Active Series Compensators, Modelling, Simulation, and Performance of Active Series Compensators, Numerical Examples. ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		
Module-4			
Unified Power Quality Compensators: Introduction, State of the Art on Unified Power Quality Compensators, Classification of Unified Power Quality Compensators, Principle of Operation and Control of Unified Power Quality Compensators, Analysis and Design of Unified Power Quality Compensators, Modelling, Simulation, and Performance of UPQCs, Numerical Examples (from 6.01 to 6.10). ■			10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.		

M.TECH POWER ELECTRONICS (EPE) Outcome Based Education(OBE) and Choice Based Credit System (CBCS) SEMESTER - III				
18EPE332 POWER QUALITY PROBLEMS AND MITIGATION (Professional Elective Course) (continued)				
Module-5				Teaching Hours
Unified Power Quality Compensators (continued): Numerical Examples (from 6.11 to 20). Loads That Cause Power Quality Problems: Introduction, State of the Art on Nonlinear Loads, Classification of Nonlinear Loads, Power Quality Problems Caused by Nonlinear Loads, Analysis of Nonlinear Loads, Modelling, Simulation, and Performance of Nonlinear Loads, Numerical Examples. ■				10
Revised Bloom's Taxonomy Level	L ₁ – Remembering, L ₂ – Understanding, L ₃ – Applying, L ₄ – Analysing.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain causes, effects of PQ problems and classification of mitigation techniques for PQ problems. • Explain PQ standards, terminology and monitoring requirements through numerical problems. • Explain passive shunt and series compensation using lossless passive components. • Explain the design, operation and modeling of active shunt compensation equipment. • Explain the design, operation and modeling of active series compensation equipment. • Explain the design operation and modeling of unified power quality compensators. • Discuss mitigation of power quality problems due to nonlinear loads. ■ 				
Graduate Attributes (As per NBA): Engineering Knowledge, Problem Analysis, Design / development of solutions, Modern Tool Usage, Engineers and society, Ethics, Individual and Team work, Communication, Lifelong Learning.				
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question is for 16 marks. • There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■ 				
Text Book				
1	Power Quality Problems and Mitigation Techniques	Bhim Singh, Ambrish Chandra, Kamal Al-Haddad	Wiley	2015

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - III			
PROJECT WORK PHASE – 1			
Subject Code	18EPE34	CIE Marks	100
Number of Practical Hours/Week	02	Exam Hours	--
Total Number of Practical Hours	--	SEE Marks	--
Credits - 02			
Course objectives:			
<ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. • Demonstrate the knowledge, skills and attitudes of a professional engineer. ■ 			
Graduate Attributes (As per NBA)			
Engineering Knowledge, Problem Analysis, Individual and Team work, Communication.			
Continuous Internal Evaluation			
CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson. ■			

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - III			
INTERNSHIP / PROFESSIONAL PRACTICE			
Subject Code	18EPEI35	CIE Marks	40
Number of Practical Hours/Week	--	Exam Hours	03
Total Number of Practical Hours	--	SEE Marks	60
Credits - 06			
Course objectives:			
<p>Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <ul style="list-style-type: none"> • To put theory into practice. • To expand thinking and broaden the knowledge and skills acquired through course work in the field. • To relate to, interact with, and learn from current professionals in the field. • To gain a greater understanding of the duties and responsibilities of a professional. • To understand and adhere to professional standards in the field. • To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. • To identify personal strengths and weaknesses. • To develop the initiative and motivation to be a self-starter and work independently. ■ 			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p>Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■</p>			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. • Expand intellectual capacity, credibility, judgment, intuition. • Acquire the knowledge of administration, marketing, finance and economics. ■ 			
Graduate Attributes (As per NBA):			
<p>Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.</p>			

M.TECH POWER ELECTRONICS (EPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
SEMESTER - III

18EPEI35 INTERNSHIP / PROFESSIONAL PRACTICE (continued)

Continuous Internal Evaluation

CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson. ■

Semester End Examination

SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

**IV SEMESRER M.Tech
POWER ELECTRONICS**

M.TECH POWER ELECTRONICS (EPE)			
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)			
SEMESTER - IV			
PROJECT WORK PHASE -2			
Subject Code	18EPE41	CIE Marks	40
Number of Practical Hours/Week	04	Exam Hours	03
Total Number of Practical Hours	--	SEE Marks	60
Credits - 20			
Course objectives:			
<ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
Revised Bloom's Taxonomy Level	L ₃ – Applying, L ₄ – Analysing, L ₅ – Evaluating, L ₆ – Creating		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. ■ 			
Graduate Attributes (As per NBA):			
Engineering Knowledge, Problem Analysis, Design / development of solutions, Conduct investigations of complex Problems, Modern Tool Usage, Engineers and society, Environment and sustainability, Ethics, Individual and Team work, Communication.			
Continuous Internal Evaluation:			
Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.			
Project Presentation: 10 marks. The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.			
Question and Answer: 10 marks. The student shall be evaluated based on the ability in the Question and Answer session for 10 marks. ■			
Semester End Examination			
SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■			

*** END ***